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ElectronicsWeek

THE MAGAZINE OF THE WORLDWIDE ELECTRONICS INDUSTRY

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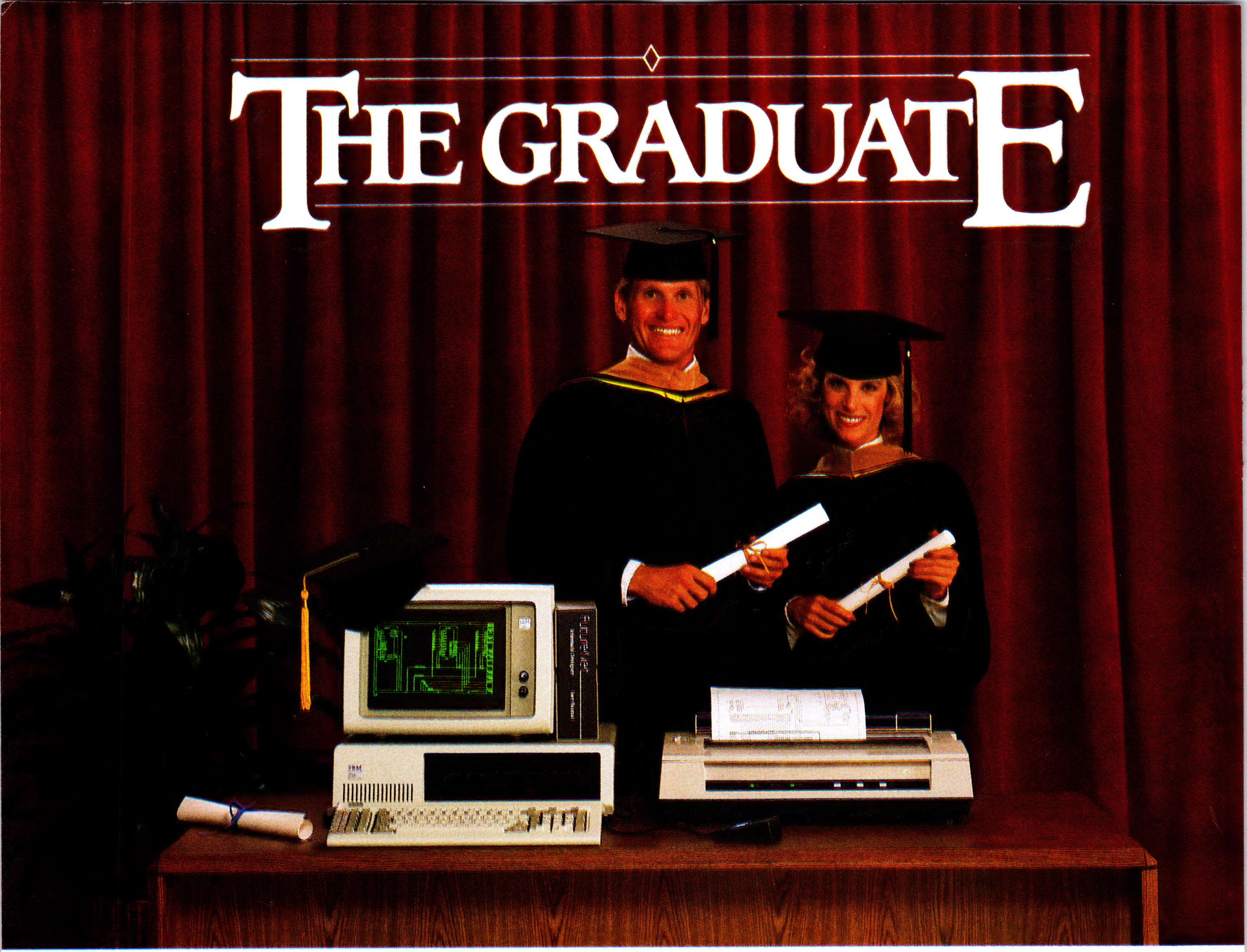

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International edition

PREVIEWS

Next ElectronicsWeek

The Asian bid for high-tech parity

The electronics communities of the U.S. and Europe often view their Asian competition as Japan and the other guys. But nothing could be further from the truth: the high-tech aspirations of South Korea, Singapore, Malaysia, Indonesia, Hong Kong, and Taiwan often take quite different courses. Trade figures reveal these nations are not only becoming independent technology exporters but are also receiving more and more value-added manufacturing contracts from the U.S. When one digs beneath the numbers and alarmist rhetoric, a very different picture of the alleged East Asian edge begins to form. *ElectronicsWeek* begins its two-part special report next week with an assessment of that picture and what it portends for other nations' high-tech futures.

New generation of Hall-effect devices

Texas Instruments' new generation of Hall-effect devices has had several of its operating characteristics improved so significantly that new applications have opened up for them. The new products, according to TI designers, have overcome problems that have plagued older devices by employing an improved orthogonal connection scheme that uses four Hall-effect devices and a modified approach to wafer manufacturing.

Looking ahead in ElectronicsWeek

Aiming for the heart of the office

An insurgent is lurking in the office telephone closet. The faithful old retainer, the analog private branch exchange, long used simply to switch voice conversations, is quietly being replaced by all-digital switches that have powerful potential. Read about what's in store in an upcoming issue.

April 22, 1985 Volume 58, Number 16
98,357 copies of this issue printed

ElectronicsWeek (ISSN 0748-3252). Published weekly by McGraw-Hill Inc. Founder: James H. McGraw 1860-1948. Publication office: 1221 Avenue of the Americas, N. Y., N. Y. 10020; second class postage paid at New York, New York and additional mailing offices. Postage paid at Montreal, P. Q. Registration Number 9034.

Executive, editorial, circulation, and advertising addresses: ElectronicsWeek, McGraw-Hill Building, 1221 Avenue of the Americas, New York, N. Y. 10020. Telephone (212) 512-2000. Teletype 12-7960 TWX 710-581-4879. Cable address: MCGRAWHILLNEWYORK.

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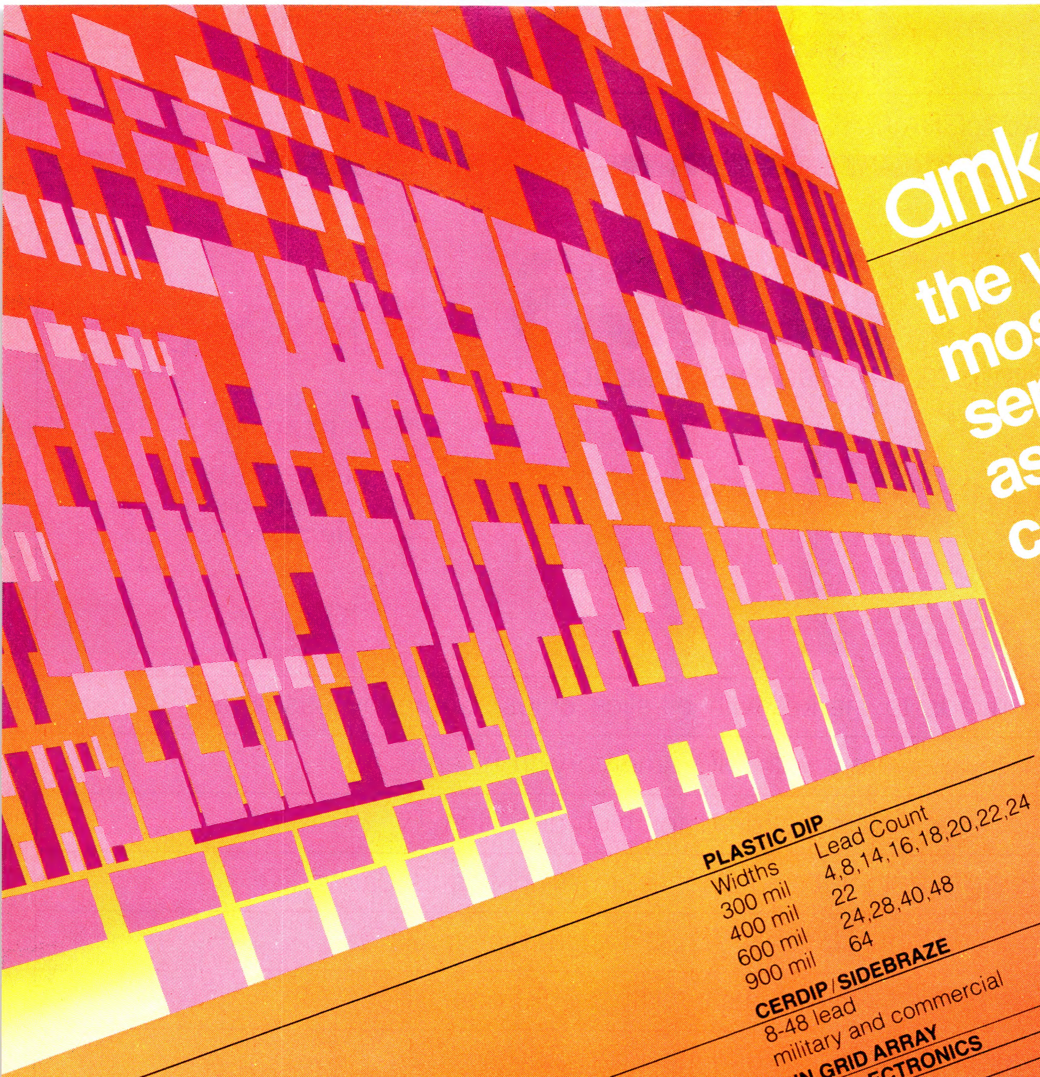

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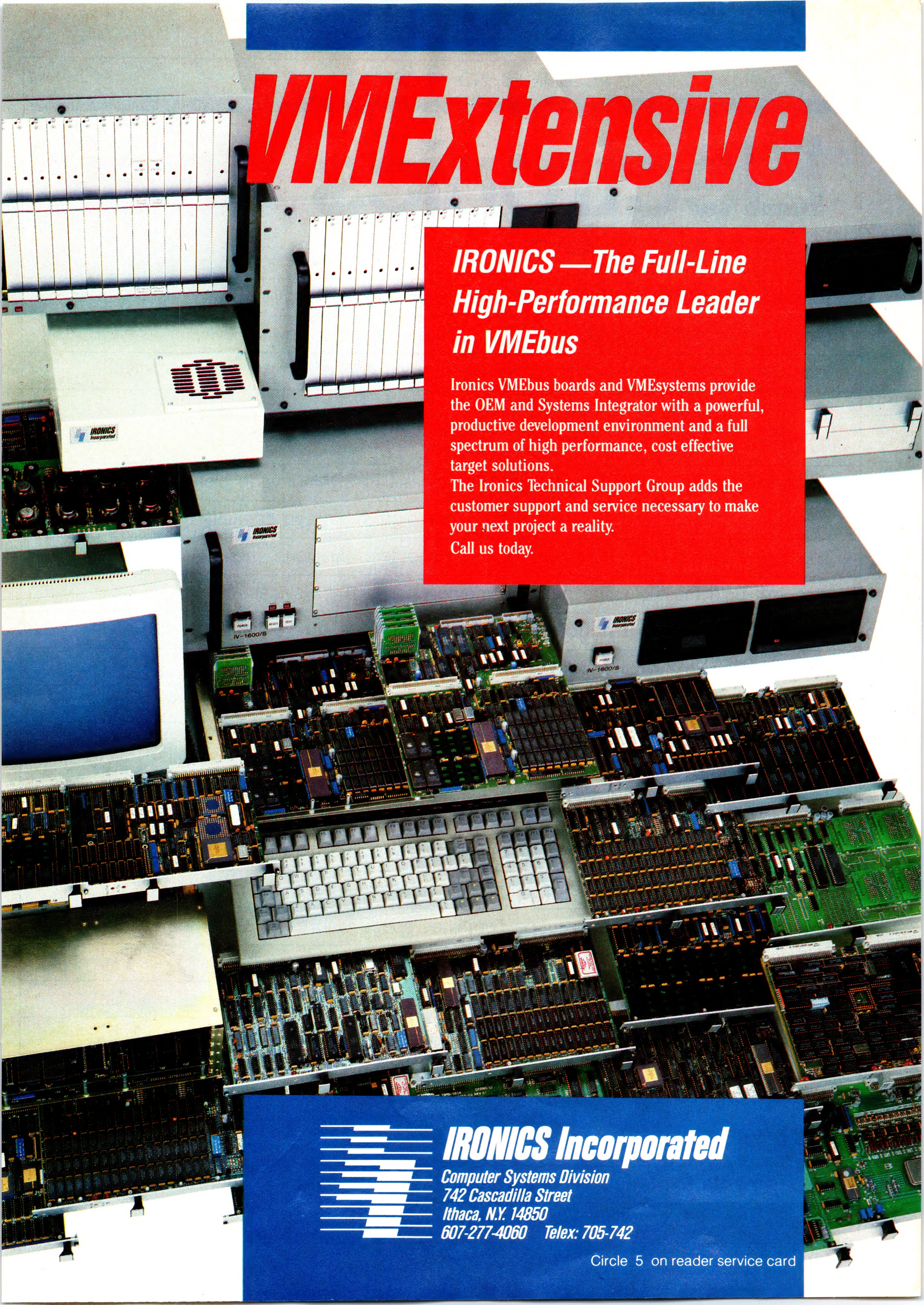

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ElectronicsWeek

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Technology Readout: Memories One-megabit EPROMs invade disk territory. A speedy, nonvolatile chip that boasts a new high in storage capacity could take the place of the disk in some computers. Just one such chip can hold the the entire program memory for a 16-bit system **52**

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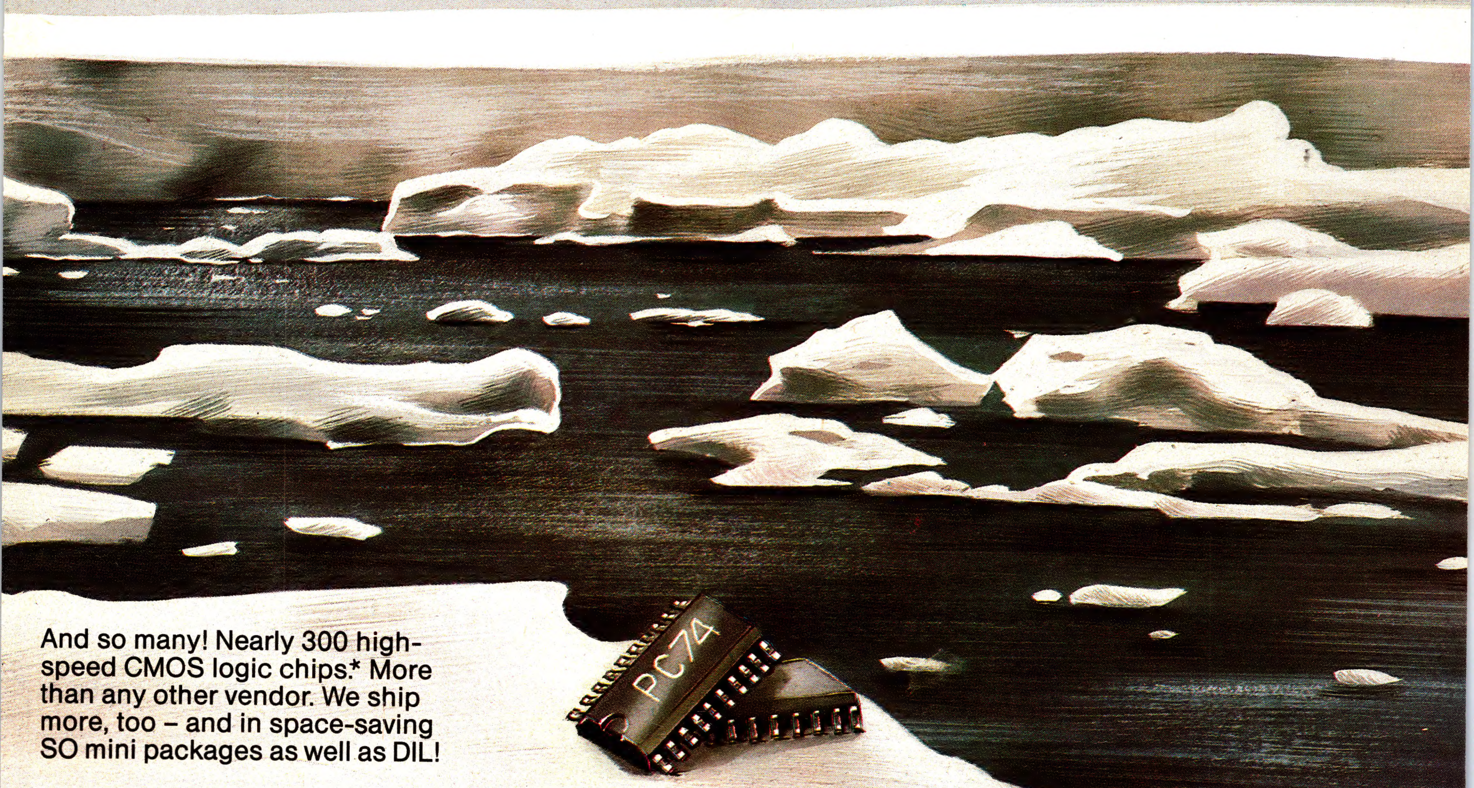

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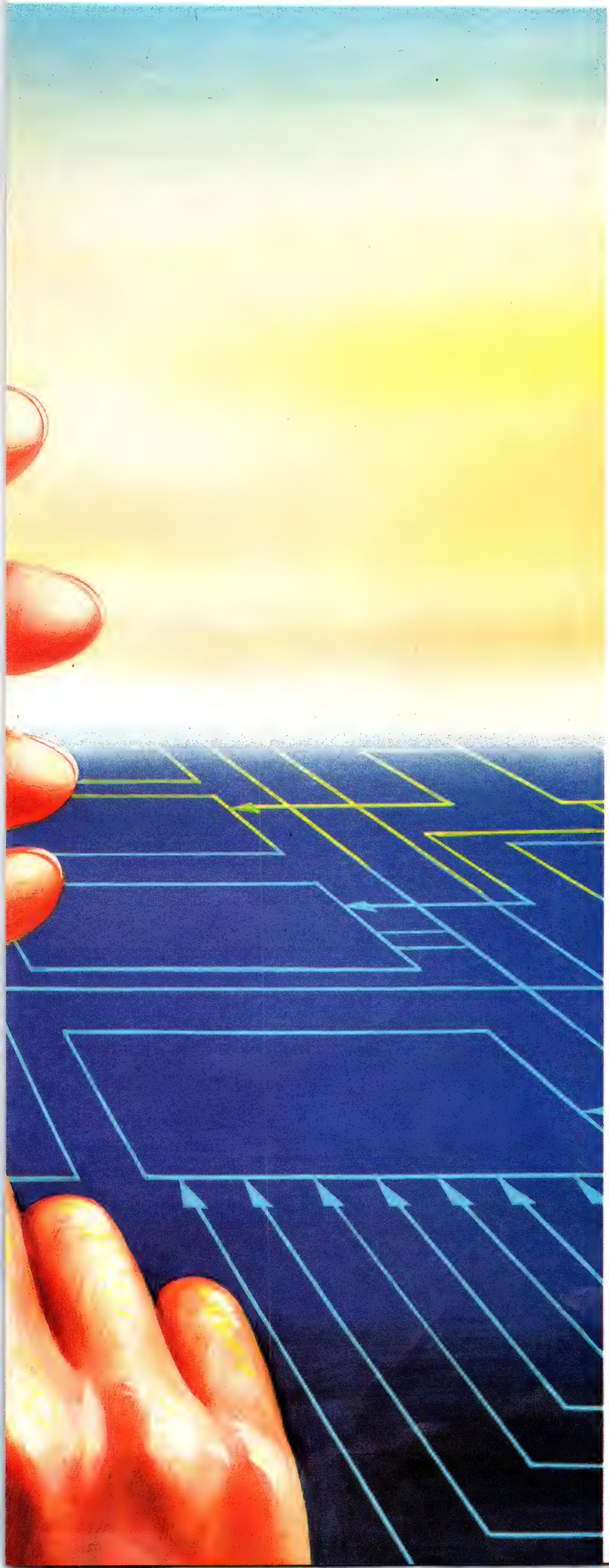

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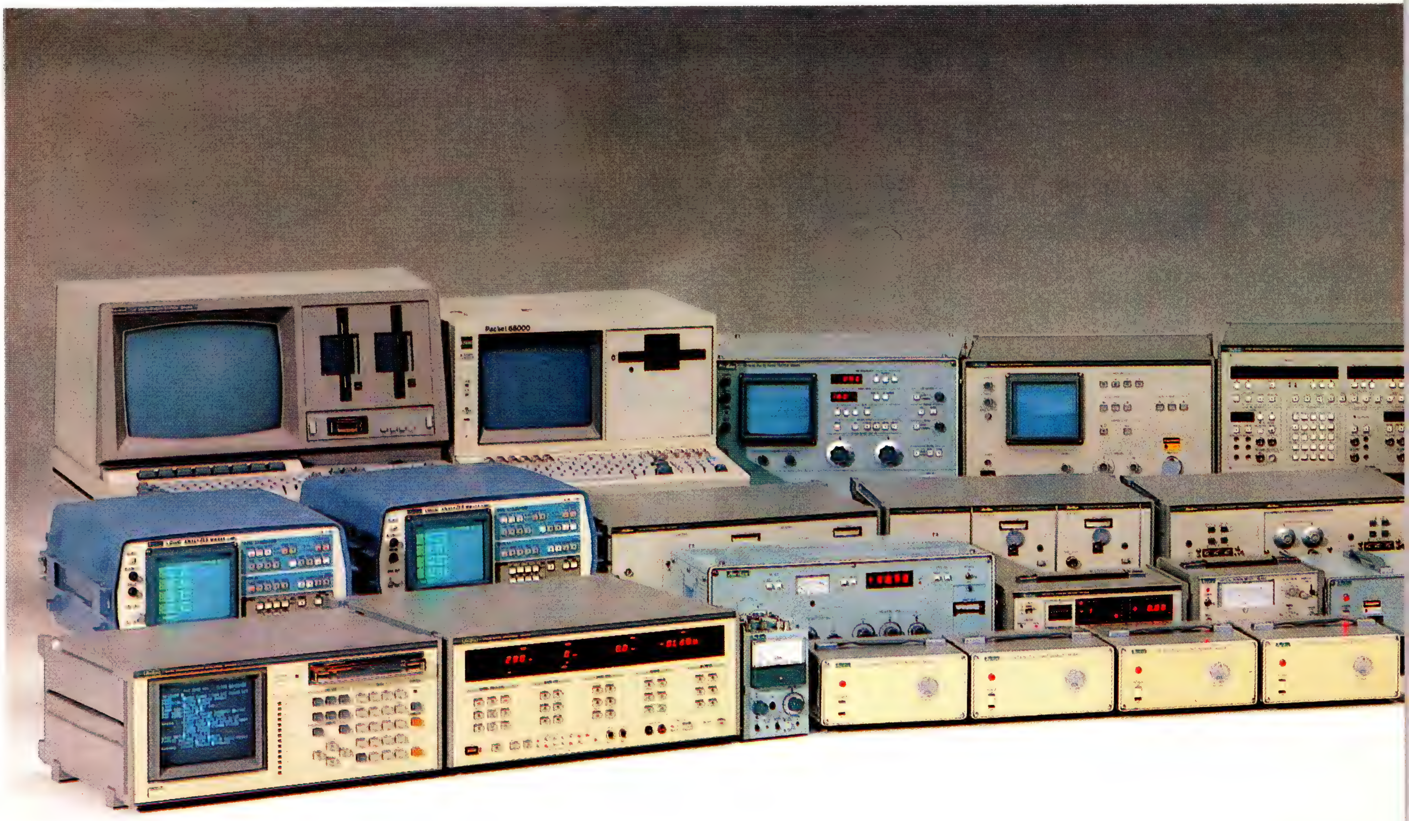

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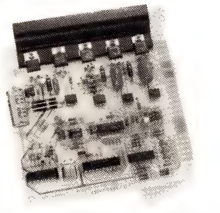

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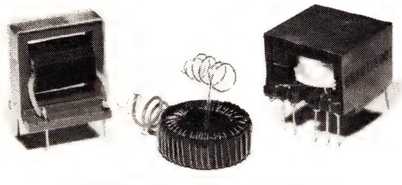

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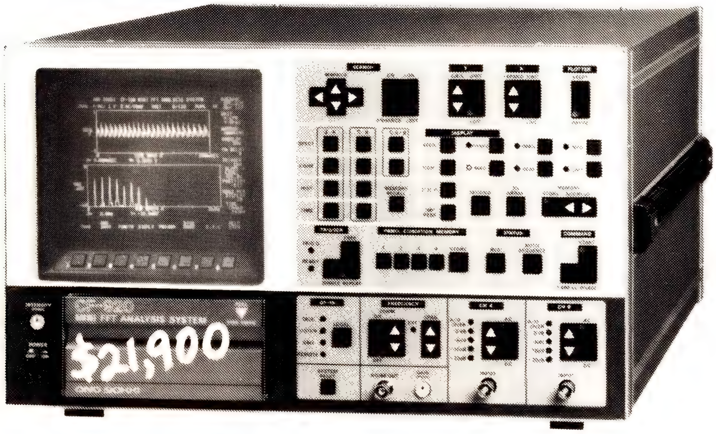

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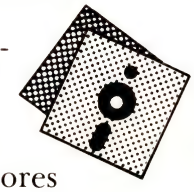

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Circle 82 on reader service card

UP FRONT

New Fujitsu supercomputer doubles as general-purpose processor

Fujitsu Ltd. has added a new twist to the supercomputer arena with its Facom VP-50, an entry-level model that can be used as a stand-alone supercomputer or a very powerful general-purpose computer. The processor's speed for vector computations is 140 million floating-point operations per second, several times that of the firm's top-of-the-line single-processor M-380; as a general-purpose computer, its speed is equal to the M-380's. For maximum economy, a user could run the same system as a large computer in the daytime and as a supercomputer at night. Fujitsu also introduced the model VP-400 supercomputer, with a speed of 1.14 gigaflops (compared with 500 and 250 megaflops for the firm's present VP-200 and VP-100 supercomputers, respectively). First shipments of the VP-50 are set for September, with monthly rentals starting at $185,000; the VP-400 is set for a December delivery, with rentals to start at $318,000. ☐

France signs $275 million telephone-line deal with China

France last week signed a contract to furnish 500,000 telephone lines worth some $275 million to the People's Republic of China. Execution of the contract is expected go to the CIT-Alcatel subsidiary of the nationalized Compagnie Générale d'Eléctricité and will include transfer of manufacturing ability as well as telecommunications research facilities. The French company signed a separate contract in February to furnish a 100,000-line digital exchange, based on its E-10 switch, to Beijing. ☐

256-K DRAM prices fall under $4 in Japan

Steadily falling prices for dynamic random-access memory chips have brought distributor prices in Tokyo for large-volume customers to below $4 for 256-K chips and to below $1.20 for 64-K parts. Meanwhile, NEC, Hitachi, and Fujitsu are expected to follow Toshiba in offering samples of 1-Mb chips by year end. The crossover to the 1-Mb generation may occur as soon as 1987, making the life of the 256-K chip relatively short. ☐

DEC hooks IBM's PCs into VAX networks

Bowing to the market dominance of IBM Corp.'s Personal Computers, Digital Equipment Corp. last week introduced a software product that allows Big Blue's PCs to hook into Decnet local-area networks. Called Decnet-DOS, the link is a layered product that runs on top of the PC's operating system. A DEC spokesman said it allows PCs to become full members of Decnets, with capabilities for file transfer, remote data access, and remote resource access. Virtual disk storage will also expand the PC's memory. Available in September, Decnet-DOS will be sold on floppy disks for $500. ☐

AT&T aims at CAD/CAM market, buys into Omnicad

AT&T Information Systems used last week's National Computer Graphics Association conference in Dallas to say that it plans to enter the computer-aided-design and -manufacturing market. One of its first steps was to acquire an equity position in Omnicad Inc., a CAD software developer in Rochester, N.Y. An AT&T spokesman said its major push will be in electronics CAD, noting that AT&T Bell Laboratories has "quite a large number of very sophisticated ECAD systems that could be made into products, probably by the joint efforts of the two companies." However, the first product to be jointly marketed and supported will be Omnicad's Omnidraft, a design and drafting system for architects and engineers that runs on AT&T's PC 6300. ☐

UP FRONT

Racal-Redac launches $20,000 pc-board CAD package for IBM PC

Britain's Racal-Redac Ltd. is bidding to set an industry standard for printed-circuit-board design packages with Redboard, a new $20,000 software package that runs on the IBM Corp. Personal Computer. The firm has already sold 115 systems and thinks it could sell 1,000 units in the first year. Redac claims Redboard is the first IBM PC-compatible package that fully automates pc-board design; other packages are basically drafting aids, it says. (see related story, page 20.) Redboard can capture logic schematics, automatically place and track pc-board components, and check for design-rule violations. ☐

Apollo package speeds design of icon-based interfaces

Apollo Computer Inc. will begin shipping a new software design package this summer aimed at cutting the time it takes to develop and debug icon-based user interfaces for engineering work stations. Sophisticated menu-driven interfaces have been popularized by Apple Computer Inc.'s Macintosh, but long development cycles have slowed their use in the technical work-station arena. Apollo's new Dialogue package, introduced at last week's National Computer Graphics Association conference in Dallas, contains high-level-language building blocks to quicken development of custom user interfaces, such as pop-up menus, icons, and integrated help facilities. Without such building blocks, these types of interfaces have taken vendors weeks to program, test, and modify, a spokesman says. With Dialogue, weeks are now cut to a matter of hours, he claims. The package comes in two parts: a user-interface design kit for software development, priced at $1,200 per node; and a user-interface management system for display and management of the interface for the application software, priced at $10,000 per site. ☐

HP to unveil low-cost plastic fiber-optic connectors

Hewlett-Packard Co. will soon introduce a family of low-cost miniature fiber-optic components housed in plastic dual in-line packages with lensed ports that mate directly with standard subminiature connectors. This new type of optoelectronic package can be soldered directly to printed-circuit boards, unlike currently available types that require special connectors. The components are also auto-insertable, making them suitable for high-volume pc-board applications. Available June 1, the products consist of a standard transmitter, a high-performance transmitter, a logic-level receiver, and an analog receiver. ☐

TI lowers its estimate of 1985 world semiconductor market

Don't look for the semiconductor industry to enjoy an immediate recovery from the business doldrums that set in suddenly last summer. That's the message from top officials at Texas Instruments Inc., who released their annual world semiconductor market forecast during last week's stockholders meeting in Dallas. J. Fred Bucy, president of the world's largest merchant chip vendor, said that industrywide semiconductor sales in 1985 would register a disappointing 15% drop to $22 billion from last year's record $26 billion. "This is a lower forecast than others that have been publicized," Bucy explained, "but we believe the impact that the weakness in the computer market will have on future semiconductor demand has not been fully realized." Reflecting the poor outlook, TI announced it would lay off another 1,000 workers during the second quarter, which would bring its total work-force reduction since December to 3,000. The major bright spot of the meeting: an announcement that TI has working silicon on a 1-Mb CMOS dynamic random-access memory. ☐

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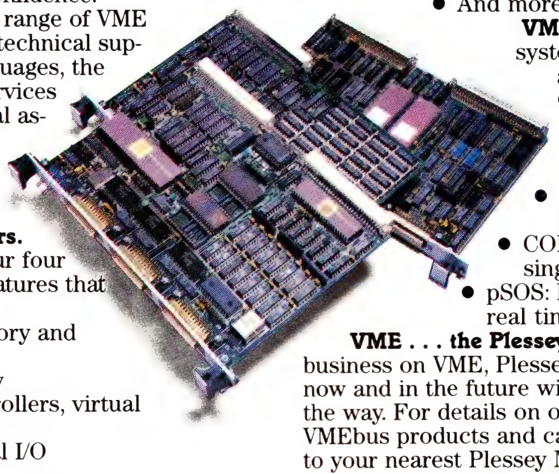

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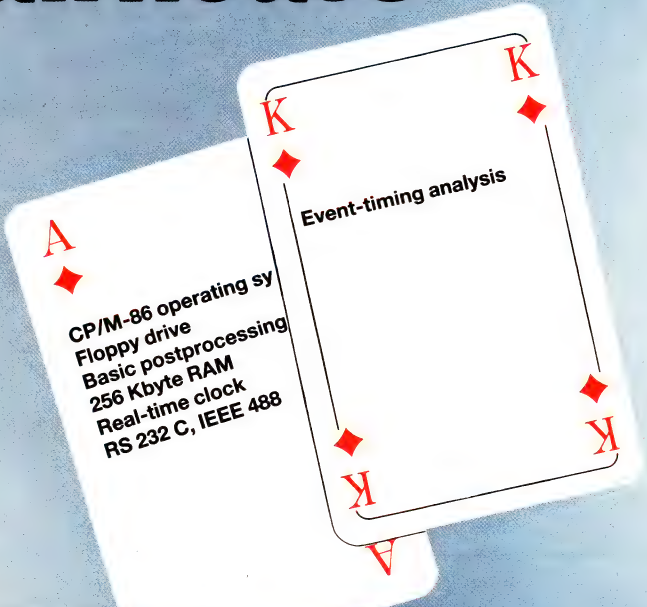

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THIS ElectronicsWeek

THURSDAY *April 11*

IBM Corp. reported its net income dipped 18%, to $986 million, the company's first quarterly decline in more than three years. Revenues inched up a bare 1.9%, to $9.77 billion. The announcement came as no surprise: late last month, IBM warned that income would decline because of the dollar's strength and lagging sales brought on by customer expectations of new product introductions.

FRIDAY *April 12*

Following recent similar announcements by ITT and IBM, **NCR Corp. cut prices on its line of personal computers by 8% to 13%** today and announced that the line's standard internal memory capacity had been doubled to 256-K bytes. NCR also introduced a 32-bit superminicomputer. Priced at $67,000, the 9400 is being billed as one of the fastest and most powerful machines in its class.

MONDAY *April 15*

EIP Microwave Inc., of Newport Beach, Calif., said today it has achieved a technical first with the introduction of two **pulse counters that extend automatic millimeter-wave pulse measurement to 110 GHz.** The counters, models 585 and 588, are also the first units that can measure pulsed signals in a multisignal environment and the first to simultaneously display carrier frequency and pulse period.

TUESDAY *April 16*

IBM Corp. said it will stop marketing its Audio Distribution System voice-messaging product in North America in favor of Rolm Corp.'s Phonemail, which is now available for users of virtually any private branch exchange. Today's announcement means that **Rolm has the potential to sell its message system to three or four times as many customers as before, using the combined IBM-Rolm sales force.** The non-Rolm PBX version of Phonemail requires a customized interface but does provide voice store-and-forward, recording, and message-retrieval functions. The Rolm 8086-based system uses a home-grown data-compression scheme. About 30 companies are in the $100 million voice-messaging market today. Expectations are that the market will reach $1 billion by 1990. . . Bucking the industry trend of shrinking sales, computer makers **Apple, Burroughs, and Honeywell all reported earnings increases.** Apple Computer Inc.'s $10 million net was up 9.9% from a year ago for its second quarter, ended March 29. Apple's figures could be misleading, however, because the quarter's results are being compared with a poor period last year when the Macintosh had not yet been shipped. Burroughs Corp.'s net rose 8.4%, to $46.6 million, while Honeywell Inc. claimed 16.7% growth, to $46.2 million for the year's first quarter.

WEDNESDAY *April 17*

AT&T Co. and Honeywell Inc. said today they have agreed to negotiate the sale of most of the assets of Honeywell's Synertek operations. No price was specified, but the potential purchase is part of AT&T's aim to increase its semiconductor manufacturing capability to satisfy both internal and external demand. The focus of the negotiations will be Honeywell facilities in Santa Cruz, Calif.; Bangkok, Thailand; Singapore; and Munich. An AT&T official said the foreign assets "could significantly improve access to the European and Asian integrated-circuit marketplace." □

TI ENTERS BIT-SLICE MARKET WITH 2-MICRON BIPOLAR CHIPS

Firm bases foray into turf long held by AMD on know-how with MOS-memory front ends

Dallas

Following a bipolar-technology roadmap drawn partly from its know-how in MOS memories, Texas Instruments Inc. is launching a second wave of advanced integrated circuits as part of an all-out drive to dominate several newly entered logic markets.

Also this week, the Dallas company is cutting prices on its surface-mountable packages in an effort to woo logic customers away from the conventional through-hole-mounted dual in-line package. The across-the-board reduction places many surface-mountable packages on a price parity with older DIPs (see "TI moves to force down SMD prices," below).

Fashioned after last summer's introduction of fast user-programmable logic arrays [*ElectronicsWeek*, July 23, 1984, p. 21], the product announcements focus TI's most advanced 2-μm bipolar process on the growing bit-slice arena. Making their debut are the firm's 8-bit AS888 chips with speeds 35% higher than leading 4-bit parts. The move comes 10 years to the month after Advanced Micro Devices Inc. began pioneering bit-slice markets with its highly pervasive Am2901 4-bit chip.

To each his own. Though TI's hopes are now riding on a speedy, low-power bipolar process, AMD is shifting some of its decade-long efforts to integrate more bit-slice functions on chip with a 1.6-μm CMOS technology. The result will be the 16-bit Am29C101, first samples of which will ship in November. TI is likewise developing a CMOS bit-slice product line. The jockeying for position between TI and AMD could set off an intense round of competition between bit-slice suppliers, which include the likes of National Semiconductor Corp. as well as startups Logic Devices Inc. and Cypress Semiconductor Corp.

What TI lacks in bit-slice market experience, it more than makes up for in volume wafer-fabrication know-how, the firm believes. Many of the fabrication steps in TI's 2-μm oxide-isolation process—known as Impact, for implanted advanced composed technology—have their roots in the firm's lines for producing 64-K and 256-K dynamic random-access memories. In fact, the new Impact fabrication lines are almost identical to the MOS-memory front ends in Texas and Japan.

"We think we have a big advantage because we are a big memory house," states Delbert A. Whitaker, senior vice president in charge of bipolar circuits at TI's Semiconductor Group in Dallas. "Much of the processing technology has been around for years in MOS, but we are now applying it as fast as possible to bipolar." The bit-slice Impact process,

TI MOVES TO FORCE DOWN SMD PRICES

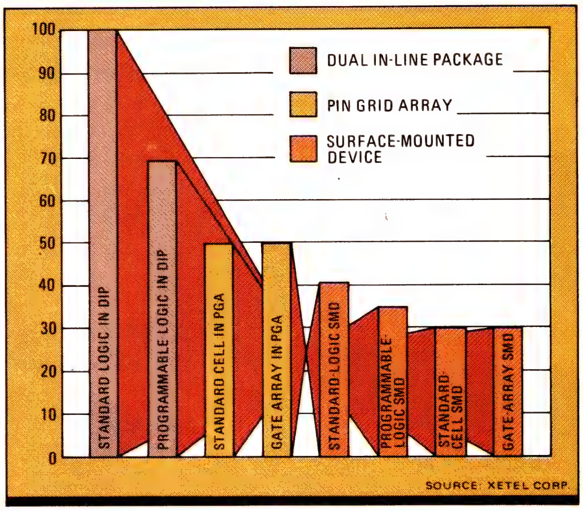
To help get surface-mountable chips on an equal footing with conventional through-hole-mounting packages, Texas Instruments Inc. this week is initiating a broad price cut on its bipolar logic housed in plastic small-outline packages and plastic J-leaded chip carriers. With the reduction, all SO packages and high-pin-count chip carriers (over 28 leads) will reach parity in cost with equivalent plastic dual in-line packages.

TI's bipolar operation in Dallas is also preparing to launch a new campaign that promotes the use of surface-mountable packages to mix standard logic and user-programmable arrays as an alternative to semicustom gate arrays or standard cells. The concept has been dubbed Densi-Flex, which TI bipolar officials say results in less than half the board space of standard logic housed in DIPs (see chart). At the same time, the mixture of standard logic and programmable arrays offers greatly reduced design cycles when compared with semicustom circuits.

For U.S. system houses, the parity pricing is a chance to catch up with foreign competitors, says Delbert A. Whitaker, senior vice president for bipolar circuits in TI's Semiconductor Group in Dallas. "TI is in the position to try and convert the market to surface mount as fast as we can. And since we are a major supplier of bipolar logic around the world, we know many Japanese firms are ahead of U.S. companies in this conversion."

But for TI—which has also initiated a similar price cut in MOS memory chip carriers—a sudden movement to surface-mounting technology would help reduce its competition, because most other semiconductor firms are just now starting to ship samples of SO and chip-carrier packages.

"That move [parity pricing] will push a lot of customers over the edge," notes Will Strauss of market research firm Forward Concepts Inc. in Tempe, Ariz. Once designs are converted to high-throughput assembly technology, system houses usually prefer to have all components housed in surface-mountable packages. "Right now, TI is just about the only one that can fully populate a board with surface-mountable ICs," Strauss adds. –J.R.L.



SOURCE: XETEL CORP.

like TI's leading-edge DRAM technology, uses wafer-stepping lithography for 2-μm lines and 4-μm metal pitch.

The result is what TI is promoting as not only the fastest 8-bit-slice processor on the market, but one with extremely low power dissipation. Running at 20 MHz, the AS888 typically dissipates 1.1 W. The high-speed and low-power characteristics of the new processor are partly due to the Schottky-transistor logic gates used for the workhorse section of the 35,000-mil^2 die and low-power TTL interface periphery. Conventional 2901 4-bit-slice processors have high-speed emitter-coupled-logic and TTL interfaces, which make for higher power dissipation, says Philip B. Coup, vice president of TI's large-scale-integration bipolar division.

In addition to having a wider bandwidth than 4-bit 2901 chips, the 8-bit AS888 can be instructed to operate on individual bits, bytes, or words. It contains three register-file operands, which allow data to flow simultaneously on three separate input/output paths without the need for performance-slowing arbitration.

The AS888 also has an expanded microinstruction set, including 13 arithmetic and logic functions along with eight single- and double-length conditional shifts. In quantities of 100, the fastest AS888 sells for $155, while a slower (16-MHz) version sells for $55. Both will be available in 68-pin plastic leaded chip carriers in May.

Helping hands. TI is banking heavily on a line of third-party development systems. Support will be coming from Hewlett-Packard Co., which, after a year of work with TI, will soon introduce an AS888 bit-slice emulator for the HP64000 series of microprocessor development systems. Support systems will also be available from Hilevel Technology, of Irvine, Calif., and Step Engineering Inc., of Sunnyvale, Calif. TI will also provide cookbook instructions for system designers wishing to use the AS888 to emulate high-speed implementations of popular microprocessors, such as Motorola's 32-bit 68020 or even TI's own TMS320 digital signal processors.

Meanwhile, AMD continues to play on its 10 years of experience in the bit-slice business by introducing a series of chips targeted at some of the most popular uses of the Am2901. "Being in that marketplace for that length of time, we have been able to develop the marketplace and watch it grow," says Chris King, product marketing manager for the Am2900 family.

The company is aiming nonslice 29116 and 29300 derivatives at 16- and 32-bit control applications, respectively. The 4-bit Am2901 building block continues to be used in designs where bandwidths are tightly coupled to the applications, notes King. The firm is integrating four 2901s and a look-ahead carry generator onto its CMOS Am29C101. "The 16-bit designs represent the most popular segment of 2901 designs," King adds.

The move parallels one being made by Logic Devices, Sunnyvale, which will start volume shipments in May of its 16-bit L429C01 slice processor. The CMOS chip incorporates the equivalent of four 2901 processors, a look-ahead carry generator, and two internal pipeline registers. Logic Devices plans to introduce a second 16-bit chip that will have a reduced number of internal registers. The high level of chip integration allows the CMOS chips to offer roughly the same speeds as four individual 2901 chips. Last December, Cypress Semiconductor, in nearby San Jose, began shipping a high-speed 1.2-μm CMOS 4-bit-slice processor, intended as a direct replacement for the bipolar 2901.–*J. Robert Lineback*

TELEVISION

DEBATE CONTINUES OVER WORLDWIDE HDTV NORM

Las Vegas

Everybody involved in TV around the world agrees that video images with sharper definition would be just fine. But how to move on from the 525-line and 625-line systems now on the air to systems displaying 1,000 lines or more has provoked considerable debate.

Out of the debate so far has come a growing consensus in the world television community that better pictures would be best achieved with a single worldwide broadcast standard for high-definition television (HDTV). This standard would eventually replace the three mutually incompatible norms used today: NTSC (National Television Standards Committee), PAL (Phase-Alternation Line), and Secam (Sequentiel à Mémoire). But the subject of what the new standard should contain provokes considerable contention.

Crux of ATSC's norms: 1,125 screen lines, 60-Hz field frequency, 2:1 interlace, and 5:3 aspect ratio

Family plan. At the TV technical sessions of the National Association of Broadcasters' Convention held here last week, for example, the United States Advanced Television Systems Committee rejected a call for the family of studio HDTV standards advanced by the Society of Motion Picture and Television Engineers. Instead, the ATSC put forth a list of recommendations for a worldwide HDTV studio standard, which could evolve into a broadcast standard. The list calls for a standard of 1,125 lines, with 60-Hz field frequency, 2:1 interlace, and a 5:3 aspect ratio. These recommendations will form the basis of proposal the U.S. will make later this year to the International Consultative Committee on Radio (CCIR).

Not everyone wants to see a single standard, however. For example, Roy Pollack, an executive vice-president for RCA, says "Perhaps there should be a worldwide HDTV standard, but perhaps advanced solid-state devices may eliminate the need to come up with whole new TV systems."

Any 60-Hz standard, of course, would pose difficulties for Europe, where field frequency is 50 Hz. "It's a major stumbling block to the Europeans, but it's a psychological obstacle, not a technical one," according to Jérome Spencer, director of marketing for Thomson Video Equipment, Gennevilliers, France. A set with an easily built converter could use the 60-Hz scan with no difficulty, he points out.

Spencer notes that neither the European Broadcast Union nor its working groups have rejected a 60-Hz standard, but no official of the EBU has yet come forward with a definite endorsement of it, either. In Spencer's opinion, HDTV is still an engineer's toy.

Like many others in the EBU, Spencer believes that the best way to start improving TV pictures is to use digital processing in the studio. The next step is to digitally correct broadcast errors [*ElectronicsWeek*, Aug. 13, 1984, p. 49]. On a home screen, he says, "You wouldn't notice too much difference between HDTV and a digitally corrected standard broadcast."

Steps on the way. Indeed, though the ATSC recommendation throws considerable weight behind a 1,125-line interlace system, commercial HDTV broadcasts are by no means ensured. Alternatively, Daniel Wells, an engineer with Satellite Television Corp., in Washington, advocates an interim step called Enhanced 525. This is a broadcast standard that present-generation TVs could receive with some modifications. Such a system would insert added data to sharpen images in the vertical blanking interval and then utilize it along with the usual image information by means of a low-cost semiconductor frame store.

Takahiko Fukinuki of Hitachi Ltd.'s Central Research Laboratory in Tokyo recently detailed how high-resolution information can be inserted into vacant frequency bands in the color subcarrier, as well as by scan-line interpolation.

All the same, Hitachi has made a strong commitment to the worldwide HDTV standard advocated by both ATSC and NHK (the Japanese broadcast network). "We have the equipment ready to transmit and receive a true HDTV signal," says Ken-ichi Ebisawa, marketing director of Hitachi Denshi Ltd., London. "We're just waiting with NHK for the CCIR to say O.K. to the new standard before we go into large-scale production." *–David M. Weber*

COMPUTER-AIDED DESIGN

AUTOMATIC ROUTING SPEEDS TOWARD AI

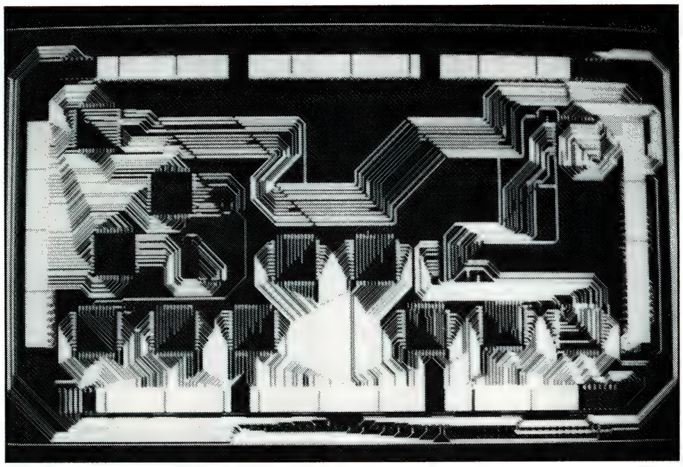
Boulder, Colo.

Board-packing chip carriers, high-pin-count components, and market pressures for swifter development cycles have system designers on edge when it comes to quickly routing and checking electrical traces on printed-circuit boards. Quite literally, the wrong turn of a trace could detour product introductions, stall performance, or curb profits because of higher manufacturing costs.

The predicament of system designers has design-automation vendors revving up the next wave of automatic-routing engines that are aimed at accelerating pc-board layout. At today's pace, the top speeds of automatic-routing engines are nearly doubling once a year, says Frank Moule, a technical consultant with Callay Systems Inc.

The Irvine, Calif., firm, which introduced its first routing product in 1982, is currently boosting speeds of its Callay V03 computer-aided design system by some 30%. About a fourth of the increase results from new hardware and the rest comes from new software with refined line-placing algorithms. The iterative automatic router, based on a Digital Equipment Corp. LSI-1123, starts at a price of $90,000. Faster products are now being tuned up for later introductions.

Even personal computers are getting into the act. At last week's National Computer Graphics Association Conference in Dallas, Personal CAD Systems Inc. introduced a $14,540 package of automatic-routing software. The San Jose firm's package can run on IBM Corp. Personal Computer AT and PC/XT machines; it is iterative and can route up to 6,000 connection points for up to 500 components on boards measuring up to 60 by 60 in.



Avoiding vias. Telesis' routing software is not iterative. Instead, the program plans out its approach, working on straight connections first. Typically, 60% of the connections can be done without expensive vias.

Analysts indicate that automatic routing has become one of the hottest arenas in the growing CAD market for pc-board design. Dataquest Inc., which this summer will initiate a study on accelerator engines in the CAD market, says worldwide sales of all pc-board design systems totaled $319 million in 1984. Pc-board CAD spending is expected to grow at a 42% compounded annual rate for the rest of the decade, reaching $1.9 billion in 1989, says Beth Tucker, senior industry analyst at Dataquest.

Coupled with the brute force of high-speed processing chips, conventional routing algorithms are being spiced up with additional software that many vendors say falls just short of being artificial intelligence.

Working both faster and smarter is a new rip-up and rerouting engine from Cadnetix Corp. of Boulder, which based much of its initial algorithm development on how human experts go about engineering pc boards. Once the knowledge was placed into software, Cadnetix spent months restructuring the initial decision-making algorithms to better suit the way its computer approached routing problems.

"So it does not behave just like a designer because we have changed the rules about what overall assumptions can be made about the design process. But we fed it all of the information we could, based on design experiences, and then observed the way it went about it," says O.B. (Buck) Feltman, vice president of marketing.

Officially introduced at a price of $77,000 this month, the CDX-75000 is based on bipolar 2901 bit-slice processors from Advanced Micro Devices Inc. The engine, which is the first of a coming series of specialized processors designed to reside on a shared network, runs on 88-bit-wide microcode instruction words similar to a previously introduced intelligent graphics accelerator for its single-user work stations [*ElectronicsWeek*, Nov. 5, 1984, p. 18].

Powering new potentials. The highly tailored architecture and extra-wide microcode allow it to execute 30 to 35 million instructions per second when applied to the nonfloating-point computations of rip-and-reroute, says Feltman. "Conceptually, the theme of this engine is you can explore certain software approaches and algorithms that were not possible unless you had this kind of processing power," Feltman says. The 88-bit microcode allows the 75000 hardware to handle several routines in parallel.

The 75000, which can be used as a shared router on an Ethernet network, has been optimized to complete 90% to 98% of the work about three to four times faster than conventional auto-routing systems, says Feltman. In addition, the system incorporates a final-pass mode, which reviews and tweaks fully routed boards that were routed automatically by the system or by a human designer.

In Chelmsford, Mass., Telesis Inc. is attacking the automatic-routing task by playing off its chip-placement software. "Our approach has been to emulate the way humans deal with design problems," says Elizabeth Winchester, Telesis' marketing manager for the pc-board design products. "It is not artificial intelligence yet, but it's pushing towards that."

Telesis' routing software is not iterative, however. Because it has prior "knowledge" of the board's design, the program plans out its approach, working on straight connections first (employing a line-probe algorithm). Winchester says that typically about 60% of the connections can be done without having to use expensive vias.

Recently, Telesis has introduced a 32-bit coprocessor, which offloads the routing process from its LSI-1173-based design system. A 350-connection layout, which takes about five hours to complete on the 1173 hardware, can be completed in half the time with the coprocessor. A fully loaded system costs about $80,000. *–J. Robert Lineback*

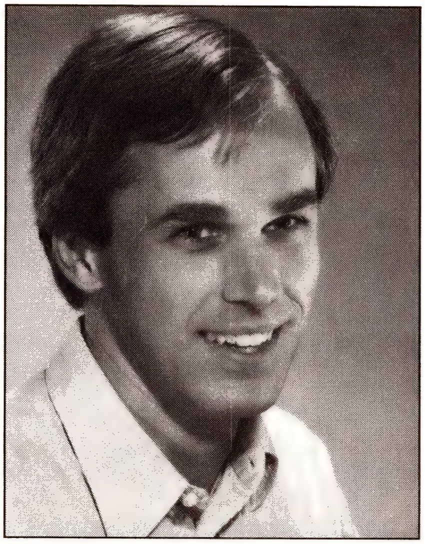
FIRMS FIND MAGIC IN COLLEGE STUDENTS' VLSI DESIGN SYSTEM

Berkeley, Calif.

If John Ousterhout has his way, even staid engineers may find themselves believing in Magic before too long. The Magic he is pushing, however, is a Manhattan-design layout editor invented by a team of students at the University of California at Berkeley and funded by the Pentagon's Defense Advanced Research Projects Agency. (A Manhattan design uses only vertical and horizontal lines, no diagonals.)

Magic's connection to Darpa has caused it to be classified as "defense sensitive," which keeps it on restricted-distribution lists. Still, Ousterhout says Darpa's desire to get technology into the commercial arena (to increase the supply of designers) pushed Magic into a strange and wonderful distribution arrangement: the program is being provided free to universities and for a small charge to private companies.

Designed by students in UC Berkeley's electrical engineering department, Magic is already enjoying a reputation as the software that designed the Smalltalk microprocessor using RISC (reduced-instruction-set computer) architec-


Helpful. Magic could train scores of new VLSI designers by simplifying the design process, says UC Berkeley's John Ousterhout.

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ture. Others now testing it for themselves will be able to use three new operations that Ousterhout says haven't been allowed before in a layout system. First, and perhaps most spectacular, is a continuous design-rule checker, which gives instantaneous on-line feedback on violations of such rules as minimum width and transistor overhang.

Automatic changes. Second, it contains a hierarchical circuit extractor, which records circuit-design changes automatically, so designs need not be reprocessed from scratch. Third is a set of interactive and automatic routing tools, says Ousterhout, an assistant professor of electrical engineering and computer science at UC Berkeley. The tools allow important networks to be routed by hand while the router directs the remaining connections around them. Soon to be added in a future release is a fourth operation called plowing, which will allow interactive stretching and compaction of chip segments.

The idea with Magic, Ousterhout says, is to let loose scores of new very large-scale-integration designers into the industry by simplifying the design process—based on the influential VLSI design text by Carver Mead and Lynn Conway, *Introduction to VLSI Systems* [*Electronics*, Oct. 20, 1981, p. 103]. To help reach this goal of boosting the ranks of designers, 30 university professors this summer in Los Angeles will attend a course in VLSI design that uses Magic. The course is sponsored by the Information Sciences Institute.

The Magic program requires at least 4 megabytes of main memory—although Ousterhout says "the more the merrier" and deems 8 megabytes the best configuration. Magic was designed to operate on systems made by Sun Microsystems Inc., as well as on Digital Equipment Corp.'s VAX machines; it is still limited to those two systems.

Already, such universities as Stanford, Carnegie-Mellon, and California Institute of Technology are running Magic, and the program is in the possession of such companies as Data General, DEC, and LSI Logic. None of the firms has made any commitment to Magic as their mainline system; instead, it is being thoroughly examined by their research and development departments.

One reason for this cautious acceptance: UC Berkeley promises no technical support for the program. "We'll be happy to listen to bug reports, and future releases will incorporate some of them," says Ousterhout. "But we provide no guarantee of technical support."

Another reason firms may be cautious about Magic may be even more basic. "I think it's a very nice system for engineers," says Abbas Elgamal, director of the systems research lab at LSI Logic. "The question is whether engineers do layout, period." But Elgamal agrees that it is important to have engineers rather than mask designers performing design layout. *–Denise Caruso*

TELECOMMUNICATIONS

UK BEATS A PATH FOR EUROPE'S RACE

London

Digitizing telephone networks was supposed to create an integrated system able to support voice telephony, data, and video traffic. But even as the first digital exchanges come on line, it is already clear that they will only partly deliver on that promise. Their narrowband, 64-kb/s (in Europe) or 56-kb/s (in the U.S.) switching capability is just not sufficient to handle some of the wideband services now envisaged.

To meet this shortfall, European countries are discussing a collaborative effort to develop a communitywide integrated broadband communications network, to be ready by the mid-1990s. The European Community has already funded an 18-month study, called RACE, for R&D Advanced Communication Technologies for Europe [*ElectronicsWeek*, Feb. 18, 1985, p. 18]. This will define what is needed and look at how it can be achieved. If the European Council accepts the study's conclusions, a broadly based program of research costing around $400 million could follow.

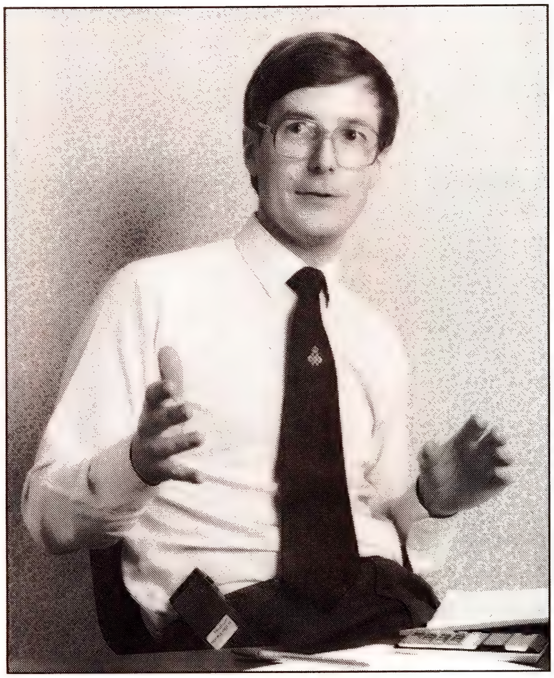
Meanwhile, in November, the Alvey directorate, Britain's fifth-generation computer project, funded two collaborative research programs—at a modest cost of $7 million—to examine the problems of establishing, and the possible applications for, such broadband services. The two British projects will use an experimental switched-star-configured data network operating at 2 Mb/s, linking up to eight sites.

Though small potatoes compared with RACE, the British effort could still blaze a trail for the larger project in several key areas, particularly as the British are building on broadband experience gained in earlier programs. "RACE is a much more broadly based program, and it's doing many of the things I would have liked to have done," says Derek L. Barber, Alvey director for infrastructure and communications. Nonetheless, Barber expects the Alvey wideband program to throw out some useful results, and it could provide valuable input to the RACE project.

Barber has authorized two wideband projects, both of which will run on an experimental 2-Mb/s switched star network. Both projects are spinoffs from an earlier (and now defunct) project, called Universe, in which geographically dispersed local-area networks were linked by satellite [*Electronics*, March 10, 1983, p. 88].

The first project, code-named Admiral, is a three-year, $3.75 million collaborative research effort into the network-management problems of hooking up large mainframes over wideband links. Up to now, says Barber, "distributed computing has meant linking low-level terminals to the same mainframe. The problems are different when large computers start talking among themselves."

Admiral will look at those network problems over and above the protocol issues, such as data encryption, network access control, and network-performance monitoring, says project leader Nick Pope of GEC Marconi



Helpful. The operational experience gained from Britain's Unison communications project will lead to new and advanced office products, says Peter Clark, who manages Logica VTS Ltd.'s involvement in the program.

Electronics Ltd.'s Great Baddow research laboratories. Other participants in Admiral are British Telecom's Research Laboratory, the University of London's Computer Center, and University College.

The second project—Unison—sets out to connect remote LANs by wideband data links to form an integrated system that can handle voice telephony, high-resolution graphics, and video traffic in real time. It brings together Logica VTS Ltd. as main contractor, along with Acorn Computers Ltd., Loughborough University, Cambridge University, and the Rutherford-Appleton Laboratory in a four-year, $3.25 million program.

Unison will examine how such a setup could provide document preparation, electronic mail, video conferencing services, and the like. Unison will also look at the role of "agents." The term, says Peter Clark, Logica's Unison program manager, "comes from the shipping world, where an agent takes care of the business of sending goods, messages, and the like from point A to point B. The difference between this and store-and-forward is the level of intelligence."

In the Unison setup, wideband LANs developed at Cambridge University's Computer Laboratory will switch traffic between the incoming data link and one or more on-site LANs. For this application, the Cambridge Fastring [*Electronics*, Feb. 23, 1984, p. 76] fits into a rack to which ring ports can be added by plugging in more two-chip interface sets. These chip sets connect directly to a standard microprocessor so each can carry out data-rate and protocol conversion. Moreover, the ring's 50- to 100-Mb/s data rate means no conversion delays are introduced—a big factor when carrying voice and data traffic.

Digital link. Cambridge, under a separate two-year-old contract from British Telecom's Martlesham lab, is also implementing on its Fastring an integrated services digital network, combining voice, high-resolution graphics, and video. The two wideband setups could be linked, says Roger Needham, who heads the Computer Laboratory.

Some hardware has already been assembled for the ISDN setup, but full implementation now awaits the arrival of the Fastring CMOS chip controller. This complex custom chip's design has been completed, and first silicon is expected within three months. The optional front-end emitter-coupled-logic chip has already been developed. Acorn funded both chips.

As for the high-speed switched star network linking LANs, it will use standard 2-Mb/s British Telecom trunk links connected to two wideband switches—one located in London and the other in the north of England. The switch was

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developed by Marconi Communications Ltd. for manually patching in dedicated data links and video conference lines; the Chelmsford firm will further modify it, however, so that connections can be switched automatically. The first 2-Mb/s switch will be set alongside a System X digital exchange at British Telecom's Baynard House switching center, in London. *–Kevin Smith*

SGS-ATES SETS AMBITIOUS GOALS FOR SLIC MARKET

Agrate, Italy

An effort by four major European telecommunications-equipment manufacturers to standardize subsystems and interfaces of their respective public telephone switches could translate into a windfall for Italy's principal semiconductor house, SGS-Ates Componenti Elettronici SpA.

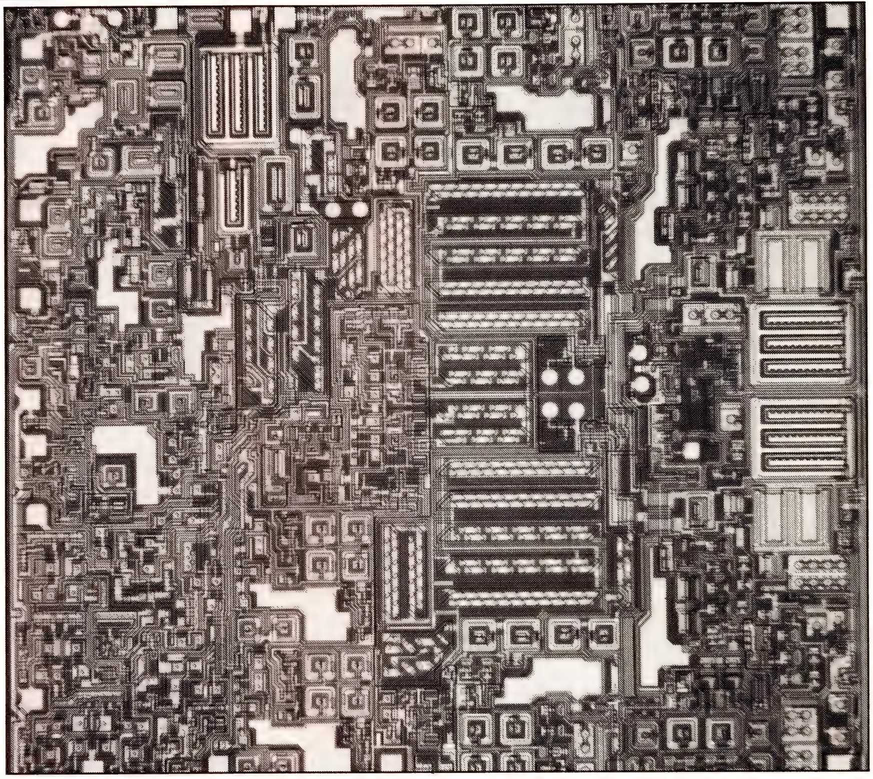
SGS already has development contracts in hand with France's CIT-Alcatel SA and West Germany's Siemens AG to jointly design subscriber-line interface cards (SLIC). It also has a less formal relationship aimed at the same objective with Italtel Socièta Italiana Telecommunicazioni SpA, like SGS a member of the government's STET telecommunications group. Based on these tieups, SGS figures it will get a jump on its competition with its two-chip kit for borsht (battery, overvoltage, ringing, supervision, hybrid, and test) functions.

Three, maybe four. CIT-Alcatel, Siemens, and Italtel last year signed a pact aimed at making their switches more compatible, and the trio will be joined this year by the UK's Plessey Co. plc. SGS hopes that it can win the British company's business as well, although Plessey has yet to evaluate the chip set. If SGS can somehow sign Plessey on, its prize would be a European market share for SLIC circuits that could reach more than 20%, which could as much as double its $20 million total sales in the telecommunications sector.

CIT-Alcatel, Siemens, and Italtel are all currently delivering their respective switches equipped with hybrid SLICs, a fact that makes them natural customers for SGS's highly integrated approach. Plessey, however, bases its subscriber cards on a high-voltage line interface circuit from the Rifa subsidiary of Sweden's L.M. Ericsson and the SLAC (subscriber-line audio-processing circuit) produced by Advanced Micro Devices Inc., Sunnyvale, Calif.

SGS telecom-product manager Riccardo Ferrari maintains he has a number of potent sales arguments to present to Plessey. "The price I've heard quoted for their two circuits is something like $20, twice what we plan to charge for our SLIC circuits," points out Ferrari.

"In addition, we require far fewer external components than [the solution that] Plessey is using now, and we only need a standard two-layer printed-circuit board while the Rifa-AMD solution requires an expensive four-layer board," he says. Per Bengtsson, marketing director for Rifa's IC division, won't comment on comparative prices but points out that Ericsson gets eight subscriber lines per card using a two-layer board.



Conversation piece. SGS's line-interface chip handles borsht functions, such as battery and ringing, that involve high voltages. It is paired with a 10-V signal-processing and control chip.

The SGS SLIC consists of two chips: the LL1300 line interface that is produced in a 250-V linear process performs the battery, overvoltage, and ringing functions of the borsht; an integrated-injection-logic 10-V chip, the LL1310, assures the low-voltage signal-processing and control functions. Nonetheless, an electromechanical relay is still necessary for the test function.

SGS plans to produce the chips here as well as in Rennes, France. It is currently shipping samples of both chips and expects equipment manufacturers will deliver switches incorporating the circuits by the end of next year.

Other suppliers expected to be strong competitors in the European SLIC market are Motorola, Texas Instruments, and Harris. SGS is looking for second sources. *–Robert T. Gallagher*

SEMICONDUCTORS

NATIONAL WINS A PLACE IN TWIN-TECHNOLOGY CLUB

Santa Clara, Calif.

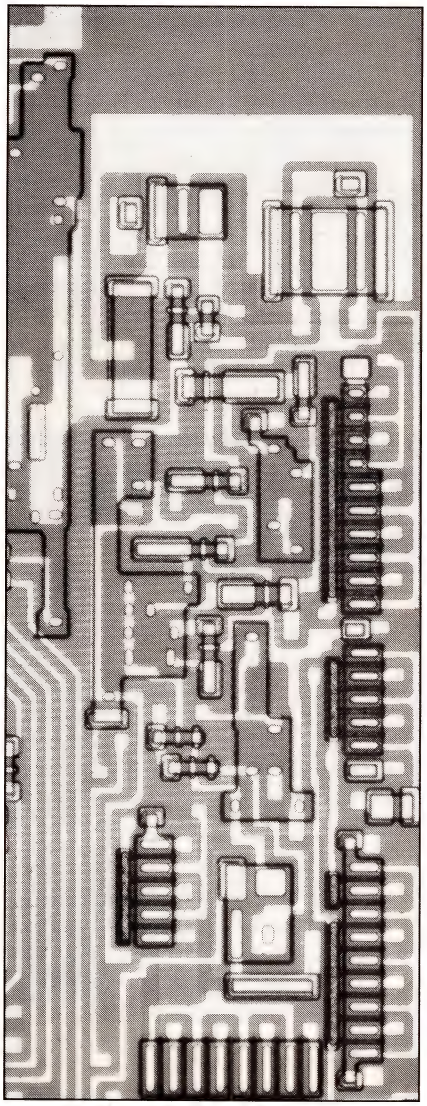
Add National Semiconductor Corp. to the growing number of chip makers that intend to have the best of both the high-speed bipolar and low-power CMOS worlds by combining the two technologies on a single chip.

National is putting the finishing touches on a process it calls Bipolar-CMOS and expects its first chip will be ready for production in about two months, reports Bruce Gray, product-line manager for bipolar logic development at National here. The first part is a revamped bipolar bus transceiver, originally the NSC DP7304 chip; while on its way to becoming the dual-technology DP73BC04, it received three extra mask steps in order to add 3-μm CMOS to the existing bipolar circuitry.

According to Gary W. Tietz, design manager for digital integrated circuits at National, the process allows optimal performance of the chip's CMOS portions because it uses polysilicon instead of metal gates. Interdigitation, or interlocking, of circuits through the extra metal layers on the chip connects the vertical bipolar processes with the horizontal CMOS, thus conserving die area. Tietz claims that the process can work with all varieties of high-performance bipolar technologies, including emitter-coupled logic and all advanced Schottky TTL circuits.

The result is a bipolar chip with much lower collector current. Tietz says the ac specifications for the chip remain the same, but when delivering power to the bus, the chip consumes a scant 35 mA instead of the 90 mA of its predecessor. In the tristate standby mode, current is reduced from 70 to 4.5 mA, a factor of approximately 15. What's more, there is no penalty in performance, because the combination needs no external chip in-

Chipmates. A cell of the twin-technology BC04 chip shows Schottky base contacts (long white areas) with emitters and collectors on either side. Small dark rectangles down the side are CMOS gate elements.



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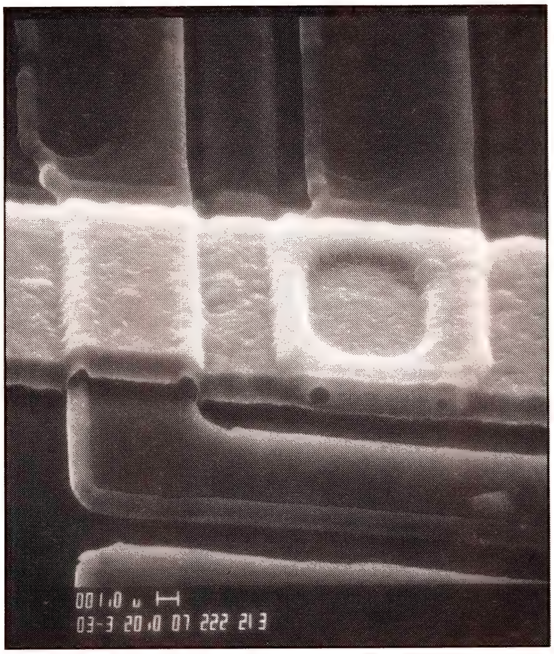
terfaces, such as input/output buffers, which Tietz claims can cut system speed by as much as 50%.

Gray claims that BipolarCMOS can be generated from either direction—that is, by adding CMOS to a bipolar chip or any advanced bipolar technology to an existing CMOS chip. In the case of the BC04, as it's called by Gray and Tietz, the first additional step that accomplished the connection was the use of "twin-tub technology," to add a p-well process to n-type epitaxy. "We grow epi and overdope with boron to make a p-well," Gray says.

Following this step, n- and p-type impurities are diffused onto the high-resistivity wafer. Next, a polysilicon mask, unique to CMOS, is added, and then the n-channel source and drain.

Both Gray and Tietz agree the most difficult problem they encountered was learning CMOS technology. "Putting in p-wells, etc., isn't that hard. But we had to understand how to do CMOS," says Gray. "We had to learn a whole new technology and adapt it to a situation. A lot of people doing this kind of thing have used band-aid solutions—either using metal-gate CMOS with bipolar, or a triple-diffused bipolar with a good CMOS process. But you really have to start from scratch to put together the best of both technologies."



Between layers. A scanning-electron-microscope image of a bipolar-CMOS chip shows the polysilicon gate between the source and drain. First- and second-layer metal connect with the contact via in the light stripe at the bottom.

Texas Instruments Inc. and SGS-Ates have already announced bipolar-MOS chips. So has Hitachi Ltd.

TI's chip, which was announced in 1982, uses a process called Bidfet that joins a bipolar double-diffused device with MOS logic. [*Electronics*, July 14, 1982, p. 147]. Designed for a bell ringer that replaces bulky electromechanical bells in telephones, the chip is now on the market. The process has also found a niche for drivers for flat-panel displays.

Triple-play chip. SGS-Ates Componenti Elettronici SpA of Agrate, Italy, which recently announced its bipolar-CMOS-DMOS process called Multipower BCD, uses linear bipolar, CMOS, and double-diffused MOS on the same chip [*ElectronicsWeek*, Dec. 10, 1984, p. 28].

Daniel Queyssac, president of SGS's U.S. operation based in Phoenix, Ariz., says that combining technologies at the chip level will gain rapid acceptance, "the same way as the integrated circuit did. It has lots of applications, since it can reduce package count in all products and provide an interface with the digital and analog worlds."

In the U.S., says Queyssac, the biggest upcoming application is in the automobile industry, where engineers would like to replace some 40 lb of copper wires and switches with a combination of chips and three wires—ground, voltage, and signal. Queyssac says SGS is working directly with a major automobile manufacturer on such a system, but would not divulge details. Samples of its first three multipower products should be available around mid-year.

As for Hitachi, the Japanese firm announced the development of its new bipolar-CMOS technology, which it calls Hi-BiCMOS, last October [*Electronics-Week*, Nov. 5, 1984, p. 17].

Cell mates. Rather than dividing up the areas for the two technologies on the chip, with the interface being bipolar and the internal gates being CMOS, Hitachi successfully distributed the two technologies in cells throughout the chip. (National uses a similar scheme.) Hitachi thus could make a subnanosecond large-scale-integration chip that reaches a switching speed of 0.8 ns, two to four times greater than conventional CMOS. Hitachi says the bipolar technology is TTL, but stresses that it reaches speeds nearly comparable to ECL chips. It also consumes 10% to 20% of the power of the former bipolar chips, or about 0.15 μW per gate.

Hitachi developed this technology for semicustom semiconductor chips. But that is a sector where Hitachi is not particulary strong. The Hi-BiCMOS process most likely will turn up first in memories, where Hitachi is a major player. An announcement could come late next month.

National says that parts are already done and production on the BC04 will be ramping up by late summer. The company has another BipolarCMOS chip already in the wings as well. The new chip is a phase-locked-loop frequency synthesizer for radio applications that can handle high frequencies—a kind of chip that generally runs hot. National's PLL divides the frequencies down to levels that MOS circuits can handle on chip, for fine tuning. *–Denise Caruso*

AVIONICS

GERMAN SYSTEM MEETS NEW ICAO STANDARD

Stuttgart, West Germany

Drawing on its expertise in air navigation systems, Standard Elektrik Lorenz AG, headquartered in this south German city, appears to have taken the lead in development of the high-precision aircraft-to-runway distance-measuring equipment specified by the International Civil Aviation Organization.

Guiding a plane to within less than ±30 meters of the touchdown point under zero-visibility conditions, SEL's precision distance-measuring equipment, or DME/P, is up to 10 times more accurate than conventional equipment, the company maintains. The accuracy exceeds that demanded by the new ICAO standards, which establish the accepted distance at ±30 m for civilian aircraft.

In development at SEL since 1981, the DME/P has successfully completed flight trials conducted by the German Aerospace Research Establishment at Brunswick airport in north Germany. This, SEL officials believe, makes their company the first to have put such a system through its paces in flight. During these trials a landing accuracy as high as 10 m to the touchdown point was achieved.

SEL is now developing prototypes from the test models. The first commercial versions should be ready by 1987, says Hans Popp, manager of the Air Traffic Systems Group at SEL.

With its new equipment, the ITT Corp. affiliate is making a key contribution toward the realization of the MLS

Flight-tested. With its airborne part in a Dornier DO-28 aircraft, the DME/P underwent flight trials conducted by the German Aerospace Research Establishment at Brunswick.

microwave landing system [*Electronics-Week,* March 18, 1985, p. 20]. This system, using time-reference scanning-beam principles, is based on an American-Australian proposal that the ICAO adopted as a world standard in 1978. The MLS is to gradually replace the instrument landing system (ILS) standardized during the late 1940s and currently in worldwide use. The major drawback of ILS is that, due to reflections, its performance is less than adequate for airports located in mountainous terrain. The use of ILS is to run out by 1995.

Third dimension. The competition for a new landing system during the 1970s led many avionics firms to concentrate first on angular landing components—azimuth and elevation—and to fulfill the ICAO requirements for them. These call for a deviation of no more than 0.6 m for elevation and no more than 6.0 m for azimuth under all terrain conditions. Little attention, Popp says, was paid to the third landing dimension—distance to the touchdown point—until the ICAO came out in favor of the American-Australian MLS version, which uses time-reference scanning-beam principles.

"During this period, we focused our work on modifying conventional [distance-measuring] systems for use with MLS," Popp points out. "We were thus able to help draw up the standards for precision distance-measuring systems." Among the adopted SEL proposals is that the equipment work with the same L-band channels as do conventional distance-measuring systems.

The complete MLS system, which incorporates the DME/P, is specified to provide continuous distance measurements simultaneous with the angular measurements during an aircraft's approach to the runway. The high precision of all measurements must also be guaranteed in the complex multipath propagation profiles typical for busy airports. In addition to distance measuring accuracy is the requirement that the DME/P be compatible with conventional distance-measuring systems now in use.

As stipulated by ICAO standards, SEL's DME/P system operates in two modes: the initial approach mode, which is effective from 22 to about 7 nautical miles to the runway; and the final approach mode, which comes into play from seven nautical miles to touchdown.

Air-to-ground pairs. As Albrecht Müller, head of navigation systems development, explains it, in initial approach mode, the DME/P system's airborne radio interrogates the ground-based equipment with pulse pairs transmitted at a 16-Hz rate and with a pulse spacing of, for example, 12 μs, depending on the channel used. The ground equipment replies with pairs of pulses with the same spacing.

As the aircraft enters the final-approach zone, the DME/P radio interrogates the ground equipment with pairs of pulses transmitted at a 40-Hz rate and with a spacing different from that used in initial-approach operation—say, at 18 μs. These pulse pairs are sent out in addition to those transmitted during initial-approach-mode operation.

The ground equipment detects the final-approach-mode pulse spacing, passes the pulses through a wideband processor, and replies with pulses spaced at 12 μs. Following final-approach-mode synchronization, the airborne DME/P part then transmits only final-approach-type pulses at a 40-Hz rate.

Conventional approach. DME/P's operation is the same as that of conventional distance-measuring equipment to ensure compatibility. Aircraft that are not equipped with the new system transmit initial-approach pulses also during the final-approach period. Naturally, they receive initial-approach replies with reduced precision compared to the final-approach replies, which makes for less accurate landing.

Responsible for the system's high accuracy are several factors, Müller points out. One factor is the system's high clock frequencies—20 MHz for the airborne equipment and 34 MHz for the ground equipment. Furthermore, the equipment's delay time is automatically and continuously stabilized in a calibration loop.

What's more, since the pulses have a 900-ns rise time compared to 2,500-ns for conventional distance-measuring equipment, distances are measured that much sooner. Finally, early triggering—at 10% of pulse amplitude—eliminates echo effects. Most multipath distortions occur after the 10% trigger point and are thus without influence. *–John Gosch*

WEST GERMANS SQUABBLE OVER CHOICE OF IFF

Bonn

A heated debate over a military electronics system is brewing in West German political circles. The dispute has members of parliament demanding the defense minister's resignation, and it could strain relations between the U.S. and Germany in future arms-purchasing deals.

At issue is the U.S.-developed Mark 15 identification friend/foe (IFF) system and a rival IFF system developed by Siemens AG. Much to the chagrin of the opposition Social Democrats and even of some members of his own party, the ruling Christian Democrats, Defense Minister Manfred Wörner seems to favor the U.S. gear for adoption by the air forces of the North Atlantic Treaty Organization countries, including West Germany's Luftwaffe.

The dispute has its origins in the Carter administration, which the opposition maintains gave the nod to a German IFF system. This is the NATO identification system (NIS) that Siemens is now developing and flight testing under a $30 million government contract as a replacement for the U.S. Mark 12 IFF system, which is currently being used by most NATO air forces. The Mark 12, NATO experts believe, is rapidly becoming obsolete: the system is susceptible to interference and to eavesdropping by the enemy.

The consensus in the U.S., however, is against the German system, mostly on the grounds that it is too expensive. In addition, its adoption as a NATO standard would mean that the U.S. would have to equip its entire military air fleet with a system operating in a frequency band different from that used in the current Mark 12 equipment and in the Mark 15 system being urged by the U.S. as a NATO standard. The U.S. IFF systems operate in the D-band at between 1.0 and 1.2 GHz—a band also used for air-safety communications, whereas the Siemens NIS equipment works in the E/F band at between 2 and 4 GHz.

Navigational hazard? German critics of the U.S. hardware, though admitting that it is less expensive, argue that the D-band is already too crowded, at least in Europe, and that additional signals in that band pose a hazard to the safe navigation of civilian aircraft. The E/F band, used primarily for military communications, is less crowded, they claim. Slight attention seems to be paid, however, to the fact that NATO is currently conducting friend/foe identification without jeopardizing the flight safety of civilian aircraft.

Bonn's Defense Ministry says that a firm decision in favor of the U.S. system has not yet been made. If the U.S. system does win out, Bonn officials say they will insist on built-in safeguards for the safety of civilian air travel. They add that a German system has little chance of being adopted by the French and British air forces.

Defense-industry observers think the dispute will likely end in a compromise. In return for Germany's adoption of the American system and as compensation for the Siemens development work, the U.S. may place some military orders with the Bonn government. The laconic comment from Siemens is that it would be "regrettable" if its NIS development work were for naught. *–John Gosch*

BOARD TESTING

HP SAYS NO TO ROBOTS FOR INTEGRATED TEST LINE

San Mateo, Calif.

Test engineers got a rare view of the future last week at the ATE Northwest conference here. It took the form of a fully integrated automatic board handling (ABH) system coupled with an in-line tester for printed-circuit boards run by an HP 3065 board-test computer.

The system, put together by Japan's Matsushita Electric Industrial Corp. and engineers at Hewlett-Packard Co.'s Manufacturing Test Division, represents a hands-on view of HP's strategy for the automatic-board-testing market. The biggest surprise at the San Mateo conference, however, was not so much what was on the system but what was not: not a single robot arm was used in the implementation.

Robot arm too slow. HP, which supplied a scanner extender interface, a communications module, and a custom test fixture for the 3065 demonstration, opted for a nonrobotic, in-line system after an extensive in-house study showed that robot arms introduce too much delay in the production process. With the in-line approach, several tasks can be performed at once. A single robotic arm requires sequential operation.

"Most automatic test equipment today isn't integrated," says David Wiltbank, manager of the Industrial Equipment Division at Panasonic Co. (Matsushita's U.S. marketing arm). "A system like this one can move boards in a fully automated fashion from insertion to solder to test."

The in-line process starts when the board feed unit accepts a loaded magazine and then feeds boards onto the testing plane, where the test fixture engages the board from the top. The test data is fed to the HP 3065, completing the tests at a rate of 200 boards every 16 s.

Both HP and Panasonic stress that the demonstration system is not a product, at least not now. For its part, Hewlett-Packard seems content to use the demonstration, and another planned for June at ATE Boston, to sell the idea of in-line automatic integrated testing to widen the market for its 3065. Matsushita, through Panasonic, sees the application as a market for its conveyor systems, magazine feeders, and associated hardware. *–George R. Davis*

NEWS BRIEFS

RCA Corp. makes progress with core businesses

RCA Corp.'s concentration on its core businesses—electronics, communications, and entertainment—is paying off. At a meeting with securities analysts last week, RCA management noted that sales for the first quarter of 1985 rose to a record $2.4 billion from last year's $2.36 billion, while earnings were up 29%, to $65 million from $50.3 million last year. "We believe that RCA performed well, considering that this was a difficult quarter for much of industry and given the competitive pricing pressures on some of our businesses," RCA president Robert R. Frederick said. Sales for the firm's electronics operations were down slightly from those of a year ago, he said, but earnings—excluding the write-off from its Videodisc business—were at last year's levels. RCA's aerospace and defense business had record sales and earnings, but earnings in consumer electronics and in the Solid State Division were lower.

Book-to-bill rate edges up in March; SIA revises annual forecast

The slump in which the semiconductor industry currently finds itself was lifted slightly last month, as the much-watched book-to-bill ratio increased to 0.86:1 from the prior month's 0.79:1, according to preliminary data from the Semiconductor Industry Association. Chip makers experienced increases in both order and shipment rates in March, the SIA said. Average monthly bookings for the three-month period ended in March rose 4.4%, to 691.1 million; March billings totaled $903.9 million, up 21.4% from February. First-quarter industry shipments fell to $2.4 billion, 6% below the same quarter last year and more than 18% below the 1984 fourth quarter. The SIA projects a second-quarter order rate between $2.5 billion and $2.6 billion, versus $3.57 billion in the same period last year, and has cut its business forecast for all of 1985 as well. SIA president Thomas D. Hinkelman noted that 1985 U.S. market shipments could be down some 10% from 1984, to approximately $10.4 billion.

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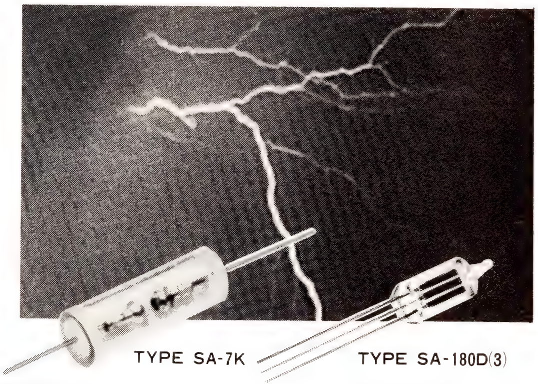

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SA-200SS	200±10%	10^{12} min	1.0	1000
SA-80	80±10%	10^{10} min	1.5	1000
SA-140	140±10%	10^{10} min	1.5	1000
SA-200	200±10%	10^{10} min	1.5	1000
SA-250	250±10%	10^{10} min	1.5	1000
SA-300	300±10%	10^{10} min	1.5	1000
SA-7K	7000±1000V	10^{10} min	—	5000
SA-10K	10000±1000V	10^{10} min	—	5000
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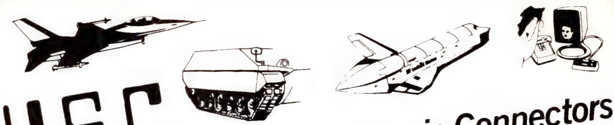

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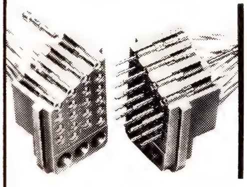

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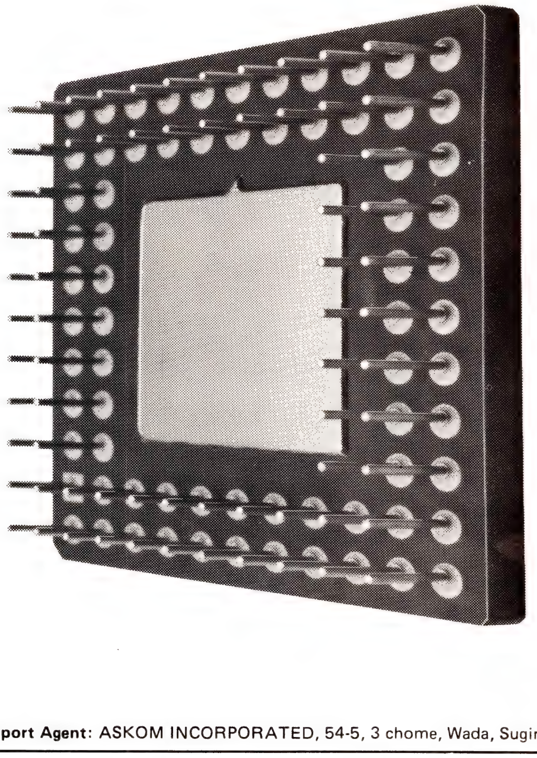

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INDUSTRY'S VERDICT:

A GOOD YEAR AHEAD

N.Y. TRISTATE REGION MAKES BID TO BECOME TOP ELECTRONICS CENTER

by George Leopold

ELECTRO/85 MARKS AGGRESSIVE EFFORTS TO GARNER A LARGER SHARE OF THE HIGH-TECH RESEARCH DOLLAR

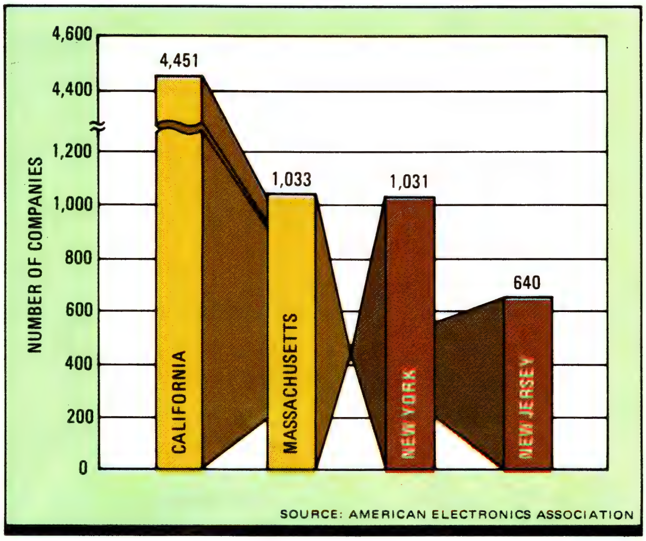
Intense regional competition for research and development dollars provides a backdrop this week for the opening of Electro/85 at the New York Coliseum. Though the show marks its 10th year here (alternating with Boston), the tristate New York-New Jersey-Connecticut region has been the focus of recent attention with the selection of Princeton, N.J., as one of four U.S. supercomputer centers. The Princeton center will likely make the tristate area one of the nation's major electronics R&D centers.

Electro/85 itself is a bellwether of the economic future of the electronics industry in the Middle Atlantic states, and what's ahead looks mighty good.

The show's organizers expect attendance to top 55,000, up from the 53,698 who passed through the turnstiles in 1983. Electro/85 will feature 33 technical sessions and over 1,200 booths from more than 600 companies during its April 23-25 stand. On April 22, it will sponsor six day-long tutorials on artificial intelligence, computers and the Federal Communications Commission, engineering work stations, entrepreneurs and venture capitalists, fiber-optic applications in electrical power systems, and speech recognition and synthesis.

This heady display of optimism shows that, in the quickening competition with other geographical areas in R&D investment, the tristate region, with New Jersey in the forefront, appears to have as good a chance as any to grab the brass ring.

According to a recent survey by the American Electronics Association, New York and New Jersey rank third and fourth nationally in the number of electronics and information technology companies (see figure). New Jersey's 1984 growth rate (17.6%) ranked third nationally, and it ranks first in the nation in its spending on electronics research.



SOURCE: AMERICAN ELECTRONICS ASSOCIATION

Go East, young engineer. The American Electronics Association's ranking of states by the number of electronics and information technology companies gives the N.Y. tristate area a strong showing.

The New York metropolitan area already boasts some of the oldest and most prestigious R&D facilities in the world. IBM Corp.'s Thomas J. Watson Research Center (Yorktown Heights, N.Y.), AT&T Co.'s Bell Laboratories (northern New Jersey), and RCA Laboratories' David Sarnoff Research Center (Princeton, N.J.) are just a few.

Hi-tech state. With the addition of the Princeton supercomputer center and an aggressive campaign by the state of New Jersey to attract high-technology companies of various stripes, the region's resources could eventually equal, if not surpass, such places as Research Triangle Park, N.C., Austin, Texas, and Portland, Ore. The Garden State, slick newspaper and television ads blare, is fast becoming the "Research and Development State."

The John von Neumann Computing Center will be located in the Princeton Forrestal Center, a 1,600-acre research park opened by Princeton University in 1975. Among the center's 50 tenants are several divisions of IBM, RCA American Communications Inc., Exxon Office Systems, and Gulton Industries Inc. These firms are part of what one center official sees as a second wave of companies that "identified [the Princeton area] as a developing market, a developing area that they needed to have a presence in to serve their own customers."

"What we've seen here over the last five years [is] what I call second-generation electronics firms which are the people that really used the silicon technology," explains Eugene D. Biddle, director of marketing at the center. "More recently, we're seeing a lot of pure R&D."

Biddle says Siemens, the giant West German electronics firm, has set up its U.S. research and technology headquarters at the center. Siemens will eventually have about 150 employees working on artificial intelligence, integrated circuit technology, robotics, and software.

Super tenant. But Princeton Forrestal's newest tenant, the supercomputer center, will likely have the largest impact on the region. Says Steven A. Orszag, director of the supercomputer project and a professor of applied mathematics at Princeton University, "I think the fact that we're locating the center in a high-tech environment is going to both enhance the attractiveness of industry coming in as well as enhance the attractiveness of our interactions with outside groups."

The von Neumann Center is funded by the National Science Foundation, the state of New Jersey, and the 12-member Consortium for Scientific Computing that Orszag currently heads. "We have a budget of $123 million over five years, of which $75 million is coming from NSF," Orszag explains, adding that the difference will be made up equally by New Jersey and firms in the consortium. "The centers are focused on basic research. In the case of our center, we do anticipate significant industrial involvement."

Center officials are now in the process of putting together "an aggressive plan for getting industrial involvement in the center both in hardware design and hardware acquisition," he continues. Noting that he has already met with an official of Exxon's research and engineering division, Orszag predicts "major announcements soon regarding exactly what we're doing."

Upgrades planned. The Princeton facility is scheduled to open October 1, with two hardware upgrades to follow, says Orszag. Control Data Corp.'s Cyber 205 supercomputer will be used for the first upgrade during the first quarter of 1987; the ETA-10 from ETA Systems Inc. will give the center roughly 50 times the capacity and power of a Cray-1 computer by the second quarter of 1988.

"The first machines will make quite a respectable supercomputer center," Orszag says. With the initial hardware upgrade, "it should be without doubt the world's largest and most formidable center associated with universities that are outside the defense establishment."

The sophistication of the Princeton center will be further enhanced by an extensive data communications network connecting the 12 consortium members. Also expected to be ready this fall, the AT&T Communications wideband network will use both T-1 and 56-kilobaud satellite communications. Further, the heads of all four supercomputer centers began meeting in late March to coordinate an overall strategy for high-speed data communications by satellite. "This is the beginning of a national network," Orszag asserts.

"The merging of telecommunications technology with computer technology is going to be a major thrust" in R&D, agrees Birute Vitenas, director of technical programs administration and analysis for AT&T Bell Laboratories, Holmdel, N.J. AT&T's annual R&D budget was $2.4 billion in 1984, of which it spent 60% in New Jersey. "We plan to continue that level of funding (for) the immediate foreseeable future," Vitenas says, meaning the next two to three years.

In addition, AT&T Information Systems will soon move into a new R&D facility in Middletown, N.J. The lab will play a large part in the merging of telecommunications and computer technology as well as in linking computers through AT&T's Unix operating system, she adds.

Vitenas thinks the addition of a supercomputer center is just one more reason why computer scientists and electrical engineers will increasingly be attracted to the tristate area. Acknowledging that she had some misgivings about resettling in the state because of its poor image—fostered by the notoriously noxious stretches of the New Jersey Turnpike that reek of strange fumes emanating from swamps, refineries, and other industrial effluvia—the California native now says "New Jersey has as much to offer as a place like Silicon Valley."

RCA's David Sarnoff Research Center, just south of the Princeton Forrestal Center, employs a staff of 1,550, including 800 who are directly engaged in research. However, Kern H. Powers, a staff vice president for communications research, says that R&D is really spread throughout the entire corporation, with a growing proportion of the development taking place at the Sarnoff center.

Powers says RCA's R&D spending, which jumped from $216 million in 1983 to almost $243 million in 1984, has grown in proportion to sales. Further, he states, "New Jersey is still regarded as a nice place to live, and the growth of R&D will really help."

Indeed, many company officials cite the region's quality of life as a key element of their recruitment efforts. AT&T's Vitenas explains that prospective employees tend to prefer either proximity to large cities like New York and Philadelphia or a rural setting.

Although IBM has no involvement with the von Neumann Center, it has kept its hand in supercomputers and agreed to install a 3084-QX mainframe computer at Cornell University's center in Ithaca, N.Y. In exchange, IBM will get 10% of the supercomputer's time for performance measurements and applications analysis. IBM spent $4.2 billion on basic scientific research in 1984, up from almost $3.6 billion in 1983. A representative at IBM headquarters in Armonk, N.Y., declined to comment on the firm's future R&D plans.

Telecom coming. The tristate area appears to be poised to exploit its telecommunications expertise. Its ability to do so was enhanced earlier this month when Columbia University was selected as a site for one of six engineering research centers. Columbia will receive up to $20 million from the NSF over five years to operate a national center for telecommunications research.

Bell Labs, IBM, and other tristate telecommunications firms such as GTE and Timeplex Inc. have already established research links with Columbia, says engineering dean Robert A. Gross. Columbia was also designated by New York State as one of seven Centers for Advanced Technology in 1983. The new center's research will focus on novel telecommunications networks with the goal of integrating voice, data, graphics, and video. A flexible network testbed called Magnet will be used to perform research.

In Brooklyn, the Polytechnic Institute of New York is also focusing on telecom research. It plans to raise $40 million of the $350 million to $500 million needed to build a nine-square-block technological-industrial park called Metrotech. ☐

PANELS COVER THE TECHNICAL GAMUT

NOTEWORTHY SESSIONS AT ELECTRO/85
(April 23-25 at the New York Coliseum)

I. Chip-oriented sessions

Tuesday afternoon: High-performance packaging; integrated-circuit testing issues
Wednesday morning: Semicustom logic
Wednesday afternoon: Programmable logic; application-specific ICs
Thursday morning: Microwave ICs
Thursday afternoon: Commercial gallium arsenide ICs; MOS-gated structures; digital systems; high-voltage ICs

II. Communications-oriented sessions

Wednesday morning: Videotex applications; integrated-services-digital-network solutions
Wednesday afternoon: Direct-broadcast satellites; lightwave components; digital TV; fiber optics

III. Computer-oriented systems

Thursday morning: hard-copy printing
Thursday afternoon: flat-panel displays; optical data storage

NOTEWORTHY SESSIONS AT MINI/MICRO NORTHEAST-85
(April 23-25 at the Sheraton Centre Hotel, New York)

Tuesday afternoon: Real-time software design
Wednesday morning: Microprocessor and microcomputer development
Wednesday afternoon: Personal work stations
Thursday morning: 32-bit microprocessor architectures
Thursday afternoon: 32-bit buses; coprocessors; controllers

ENTREPRENEURS BET ON THE BIG APPLE

As research and development dollars for electronics and telecommunications continue to pour into the tristate area, the city of New York is doing more than merely playing host to Electro/85. Drawing on the talent and resources of the city's many universities, startup electronics firms are beginning to pop up in unlikely places such as lower Manhattan and the South Bronx.

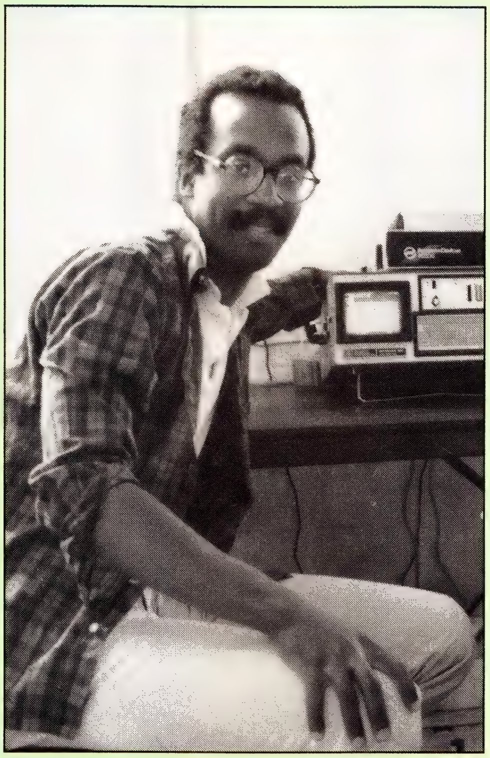
Protocom Devices Inc., a two-year-old startup currently in Stamford, Conn., is moving its operations to an industrial park in the heart of the Bronx. During the transition, the privately held telecommunications firm occupies an 8,000-ft² "incubator" facility in the ravaged but slowly recovering South Bronx. One of Protocom's founders, Ralph Collado (see photo), argues that locating in what was the nation's symbol of urban blight makes sense.

"Our feeling was that New York City, purely for sound business reasons, was an ideal place to locate a high-technology firm," argues Collado, a native of the South Bronx and a graduate of Brooklyn's Polytechnic Institute of New York. Citing the firm's proximity to institutions such as the Institute, Columbia University, New York University, and Manhattan College, Collado says, "We have developed within the past year excellent relations with all of them—relations that extend toward joint research, market analysis, administrative and organizational help."

Moreover, in February Protocom underbid 10 other companies—including Amdahl Corp.—to win a $1.5 million contract to supply Boeing Computer Services with P250 packet assemblers/disassemblers for an X.25 packet-switched network that the Boeing Co. division is now installing for the Commonwealth of Pennsylvania. The contract marks the first time that Protocom will sell its P250—a packet assembler/disassembler that is designed for dispersed terminal concentrations having low terminal-population densities.

Last October, Protocom won a contract worth $685,000 from Paradyne Corp., of Largo, Fla., to provide packet assemblers/disassemblers for a banking network to link a Sperry-intensive installation in California with a southern Florida installation made up primarily of Burroughs mainframes.

Building on the Boeing and Paradyne contracts and a $4.4-million lease-financing agreement with the Port Authority of New York and New Jersey, Protocom expects to do $7 million worth of business in 1985, compared with about $1.2 million last year, according to Ramon Morales, the firm's 31-year-old president. This isn't bad for a company that once asked its employees to work without pay for three months.



Protocom currently has 7 full-time engineers and a sales and marketing staff of 10. Morales expects the payroll to grow to 55 by year-end and double that by the end of 1986. When Protocom moves into its new 40,000-ft² manufacturing facility early next year, it could provide up to 300 badly needed jobs in an area suffering from chronic unemployment. Further, Collado maintains that he can attract technically competent staff directly from engineering schools in the city of New York.

The enthusiastic Collado, 30, who has worked for ITT Corp.'s Courier division, GTE Corp.'s Telenet division, and most recently as a senior product manager at Timeplex Inc., considers the New York area nothing less than Silicon Valley east. "We are at the forefront here in New York City of a technological revolution."

In neighboring Manhattan, Philon Inc. is developing and marketing some of the industry's fastest language compilers for 16- and 32-bit microcomputer systems in a rehabilitated loft building. Founded in 1981 by a group of developers trained at nearby NYU's famed Courant Institute of Mathematical Studies, Philon has increased its staff from 26 to 80 employees, which includes a technical group of more than 50.

Robert F. Gildenberg, 40, Philon's marketing vice president and a former City University of New York professor, explains the firm's growth simply: "New York City evolved the company."

Philon president and chief executive officer Michael J. Parrella says one third of Philon's technical staff came from NYU and the majority from other universities in the city. For example, Clinton G. Goss, director of research and development, participated in the design of the first Ada compiler at the Courant Institute.

Parrella, 37, adds that the lack of competitors specializing in high-speed compilers has meant no staff turnover. "There's no where else to go," he stresses. Philon's ability to limit turnover is especially significant in light of a recent study by the American Electronics Association. The study found that the New York metropolitan area has the highest overall turnover rate (20.7%) among electronics industry engineers and the third highest turnover rate (25.1%) for software engineers.

Last year, the privately held firm acquired Mag Software, a developer of software programming tools, located in Canoga Park, Calif. The new division, which is known as Philon West, will also serve as a West Coast sales office.

As Philon seeks to expand nationally and internationally, Protocom wants to set down deep roots in the Bronx by cultivating the image of a "company with a conscience." All Protocom employees hold stock in the company, and many learn new technical skills on the job.

For example, technicians receive instructions on putting together P250 packet assemblers/disassemblers while office workers attend computer classes at nearby Manhattan College. "It's an entrepreneurial exercise," explains Collado. "What we have to do is lead people, not manage them." **–G.L.**

SPEECH TECHNOLOGY TAKES SLOW BUT STEADY COMMERCIAL COURSE

by Robert Rosenberg

SYNTHESIS IS A MARKET REALITY, BUT RECOGNITION IS GIVING RESEARCHERS A RUN FOR THEIR FUNDING

Some crowds are hard to work—they need warming up. But a speech maker introduced to a crowd of speech-synthesis and -recognition enthusiasts, such as the one meeting this week in New York for Speech Tech '85, can count on a friendly reception. The word at the show (and the one that will go out to the small community actively involved in speech synthesis and recognition) is that speech applications are springing up all over the world—and even out of it. But the big break in the market that speech people have been expecting for several years is still to come.

"Synthesis is really here. It's just a question of how good you want it to sound and how much you can spend," says Douglas O'Shaugnessy, a professor at the University of Quebec's Institut National de la Recherche Scientifique. During the three-day event, coverage of speech-synthesizer applications will range from vending machines speaking Japanese to high-security communications systems.

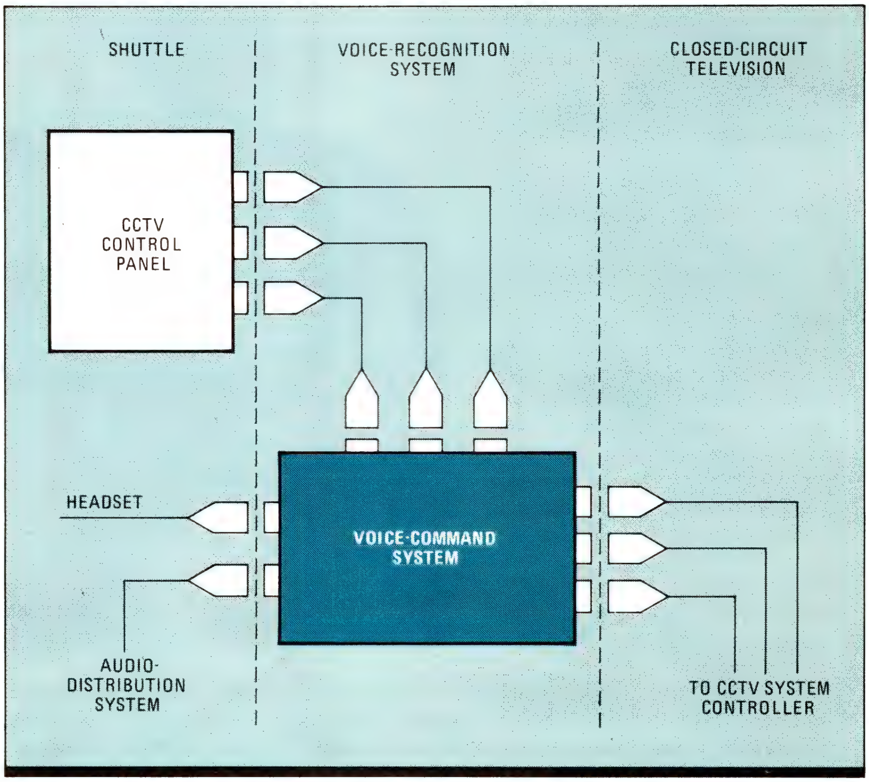
Hot topic. Ever since the government announced it will be investing billions in a new telephone system [*ElectronicsWeek*, Feb. 18, 1985, p. 17], building high-security systems has become a hot topic among those working on speech synthesis. The Multiple Rate Voice Terminal described by George Rosen, a senior researcher at GTE Government Systems Corp. of Needham Heights, Mass., uses bit stripping and padding of LPC-10 synthesized speech to produce high-quality speech sounds on channels with different data rates.

The system eliminates tandeming degradation—the poor intelligibility occurring when a voice synthesized at one rate is analyzed at a new rate—that plagues conference callers by automatically compensating for different channel rates with its imbedded coding. All algorithms are implemented on a GTE Mark IV-J processor, a version of Advanced Micro Devices Inc.'s 2901 bit-slice arithmetic logic unit that has been optimized for signal processing and pipelining. It executes instructions in 150 ns.

Two small boards, fitted into an ITT Type 2830 modified for special control functions, is all that Technical Communications Corp. of Concord, Mass., needs to deliver toll-quality encrypted speech at 14.4 kb/s, according to Arnold M. McCalmont, president. Using continuously variable delta modulation to digitize the speech and either the proprietary DSD72A encryption device or a DES-based algorithm, McCalmont says he can deliver a highly secure system. The DSD 72ASFD is a synchronous, full-duplex data-security device implemented on a single board. It has independent circuitry for encryption and decryption functions and transmits and receives simultaneously.

In the speech-technology community, recognition is acknowledged to be the harder technological nut to crack. Thus a lot of interest in research focuses on both the high end, in products such as voice-activated typewriters, and at the low end, in a simple system that will be flying in the space shuttle.

No breakthrough yet. Enthusiasm among engineers runs high, but when the money men start talking speech technology, they caution restraint. Herbert S. Kleiman, vice president at Prescott, Ball & Turben, the Cleveland investment firm, leads the session on the business aspects of speech technology. He says that the breakthrough product the industry has been waiting for hasn't arrived—it isn't even on the horizon. Kleiman says that the industry looks flat. "It is my feeling that progress the past year has been minimal. There have



Voice control. To help a floating astronaut handle the shuttle's robot arm and a closed-circuit TV, a voice-command system controls the circuitry of the TV control panel. Commercial EPROMs load templates of the astronaut's voice into the system before the flight.

been some successes, but the industry is certainly not running at a gallop."

Janet Baker, president of Dragon Systems, a speech-processing research and development outfit that licenses its recognition technology, is a little more optimistic. "The speech-recognition industry is in a tremendous state of flux," she says. The projections of high market growth made in years past were the results of analysts' naiveté, but she is convinced that the technology is now ready: "the market is really taking off now."

But if speech technology has a favorite son, it is the voice-input typewriter, reported to be under development by IBM, Kurzweil Applied Intelligence, Speech Systems, and others (see "Kurzweil almost ready for market," below).

Recognition systems are qualified by three dimensions: the size of the vocabulary they can handle; the system's fluency, or whether the words can be spoken naturally or must be separated by artificial pauses; and the degree of speaker dependence—that is, whether the speaker has trained the system by providing a template against which a spoken phrase is matched. Isolated words are easier to process than continuous speech, and speaker independence is about an order of magnitude more difficult to handle than a system that has been trained by the speaker.

Users' needs. Speech Systems' president, William S. Meisel, brought along a shopping list of features presumably being built into the firm's voice-input typewriter, but was quick to point out the danger of packing sophisticated processing into a machine without considering what the users want. He says a voice-input typewriter should accept continuous speech, deliver the result in natural syntax, and be able to adjust dynamically to the speaker's speed and vocabulary with an acceptable degree of accuracy. "They are as important as the processing technology," says Meisel.

But analyst Kleiman says voice typewriters may turn out to be a mixed blessing. "What concerns me is the unkept promise. Too much publicity can lead to expectations that cannot be met." Kleiman finds his silver lining in space applications because the military has traditionally been ready to pay a premium price for performance.

If analysts are pinning their hopes on big spenders in space research to push the state of the art, they may be way out of orbit. At the Johnson Space Center in Houston, the National Aeronautics and Space Administration is working on a project to use a voice-dependent recognition system to position and focus a closed-circuit TV needed to control the shuttle's robot arm. But according to the presentation made during the panel of Avionics and Space, it's all going to use simple off-the-shelf hardware.

William T. Jordan, a project engineer at the Johnson Center, explained that during the shuttle's 13th mission, when astronaut Terry Hart was working the controls to hook the shuttle's arm onto the errant Solar Max satellite, the flight plan also required that he act as cameraman and track the arm's movement on the shuttle's closed-circuit TV. Coordinating the two tasks proved too demanding, so the shots were never taken.

Full drawing board. NASA learned from the experience and is now building a Voice Command System that will directly parallel all the switches on the closed-circuit TV's manual control panel. Since a labor glut should not be a problem in space flight for a long time, Jordan says more systems are on the drawing board using speech recognition.

The voice-control system being readied for the shuttle is relatively straightforward. Templates of the speaker's voice are loaded into one or more commercially available 2764 erasable programmable read-only memories installed in the voice-recognition system just before flight. "Think of it as a slightly sophisticated Atari game cartridge," Jordan says. About 50 words will be needed to control such functions as selecting monitors, cameras, panning, tilting, focusing, zooming, and iris control. Verification feedback images will come directly from the cameras.

"Many of the system's details are still up in the air," Jordan says, but he is confident the system will soon be flying and that speech recognition in a microgravity environment ought to yield some interesting data.

Japanese headache. If astronauts think they have their hands full, they should consider the plight of the Japanese typist facing a keyboard designed to handle 2,000 ideographs. Japanese keyboards are not for the faint-hearted, says keynote speaker Michiyuki Uenohara, vice president of NEC Corp. They are huge, and each of their dozens of keys has several functions, so Uenohara says the Japanese are investing heavily in speech synthesis and recognition—and are probably surpassing the West—in order to overcome what he descibed as the man-machine barrier.

Uenohara described a voice computer-aided design system, which combines logic-design CAD with natural-language input equipment and an expert routing system for very large-scale integration design. But if there is a single system bound to warm the hearts of speech makers, it is undoubtedly the real-time telephone translation system, currently being demonstrated at the Tsukuba, Japan, Expo '85. Uenohara says this system will turn Japanese into English, French, and Korean. ☐

KURZWEIL ALMOST READY FOR MARKET

The name that has probably received the most publicity in speech recognition is Kurzweil Applied Intelligence Inc. [*ElectronicsWeek,* Oct. 22, 1984, p. 83]. Although the Waltham, Mass., firm's ultimate goal is to develop a machine that transforms the sound patterns and intonations of natural speech into type, its immediate goal is more modest.

The Kurzweil Voice System 3000, its first entry into the commercial speech-recognition market, is scheduled to become available later this year. It was designed primarily for original-equipment manufacturers who want to add speech recognition to their products and for end users who require hands-off computer-keyboard entry. "It is not designed to accept dictation," says Richard S. Goldhor, director of software development at Kurzweil Applied Intelligence. "The KVS can store 3,000 tokens [acoustic patterns] and match all of them against incoming speech signals in real time, so it can recognize vocabularies on the order of 1,000 words. But full dictation generally requires vocabularies in the 10,000- to 15,000-word range."

Because one of the most important applications for the KVS 3000 will be as a speaker-dependent data-entry tool for utility programs such as business software, the actual speech processing takes place before the appropriate text strings are passed to the programs, so that the programs are not altered. In addition, the unit's modular design permits a variety of configurations with a host computer.

In one such design, the voice system is configured as a packaged set of boards to interface with an IBM Corp. Personal Computer AT or PC/XT. Another design permits its use with Multibus systems.

When it reaches the market, each KVS will sell for about $6,000 and will include an RS-232-C interface. As a Multibus-compatible board set, its price should be around $3,000 in OEM quantities. "But more important for KAI's long-range plans is that the KVS will be an essential building block for a true voice-to-text typewriter," says Goldhor. **–David M. Weber**

MONEY STARTING TO FLOW AS PARALLEL PROCESSING SUDDENLY GETS HOT

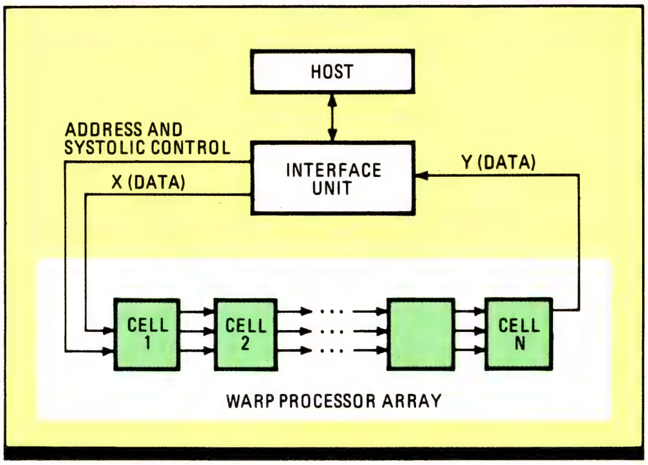
by Wesley R. Iversen

PRIVATE RESEARCH RECEIVES A DOUBLE DOSE OF SUPPORT AS INDUSTRY AND GOVERNMENT FUND UNIVERSITY PROJECTS

The idea of hooking together huge numbers of processors in parallel to produce ultrafast computers has long fascinated university researchers. Indeed, some have been studying parallel computing architectures for nearly 20 years, and an estimated 50 or more parallel-processing research efforts are currently under way at some level in U.S. schools.

Until now, however, a scarcity of funding has kept most of these projects stuck in the laboratory [*Electronics*, June 16, 1983, p. 107]. Few have moved beyond the paper or small-prototype stage. But a number of university projects are about to get a federally financed shot in the arm.

In many cases, the funding will enable researchers to test out their architectures and software in actual medium- and large-scale hardware prototypes. Some projects contemplate eventual use of hundreds, thousands, or even a million processors working in parallel to circumvent bottlenecks imposed by today's conventional von-Neumann-style architectures.



Warp machine. The cells in Carnegie-Mellon's Warp processor array, a one-dimensional systolic array, are replicas of the Warp cell. The array is synchronized by a single clock issued by the interface unit.

The funding comes most notably from the Defense Advanced Research Projects Agency's $600 million to $700 million Strategic Computing Initiative. Its goal is to develop massively parallel machines that some believe will be the basis for next-generation military and commercial systems, with speeds a thousandfold or more beyond today's fastest supercomputers. Besides Darpa—which is devoting about 25% of its SCI budget to parallel-architecture work—agencies including the Department of Energy and the National Science Foundation this year also stepped up their funding of massively parallel designs, though not on so grand a scale.

To be sure, a number of industrial firms, particularly startups, are believed to be working on proprietary parallel architectures of their own. Supercomputer vendors such as Cray Research Inc. and Denelcor Inc. have already installed four-processor parallel machines at customer sites, and along with others, such as ETA Systems Inc., are working on next-generation designs that will employ from 8 to 16 processors in parallel.

Risky business. But few vendors have been willing to investigate riskier long-term designs involving the kind of massively parallel architectures found in the universities, notes Donald M. Austin, program manager for the DOE's Applied Mathematical Sciences Research Program. Since agencies such as the DOE foresee future computing needs that can be met only by such large-scale parallel designs, federal funding is necessary to help push these projects out of the lab toward real-world applications.

"This is really fantastic. I'm so excited about this whole thing," says H.T. Kung, a researcher at Carnegie-Mellon University, whose school landed a $19 million, three-year SCI contract to pursue parallel-architecture research last October. "The federal government is much more willing to do new computer architectures than they were three or four years ago, and anybody who is serious about building machines can probably get some funds now."

Other researchers, whose projects have not received stepped-up federal funds, are less enthusiastic. But most agree that interest in the area is on the upswing, and many are looking for outside industrial funding to keep their projects moving.

At New York University, for example, where combined DOE and NSF funding has recently remained level at about $750,000 per year, researchers are talking to IBM Corp. about building a prototype machine based on the school's multiple-instruction multiple-data (MIMD) ultracomputer architecture. The school is developing operating systems not only for its own eight-processor prototype machine based on 68010 microprocessors but also for a much larger enhanced-architecture prototype that IBM is considering building at its Thomas J. Watson Research Center, says Allan Gottlieb, NYU's principal investigator for the ultracomputer project.

By one estimate, the project could involve "millions of dollars worth of engineering effort" by IBM to build a massively parallel machine incorporating its own architectural enhancements. IBM confirms that it is talking to NYU about the project, but it has not yet made a decision. The firm is also evaluating other parallel architectures, a representative says.

Spinoffs expected. Darpa's SCI program is aimed at specific long-term military applications that include signal processing and symbolic processing related to artificial-intelligence uses. Nonetheless, SCI is also expected by many to foster commercial spinoffs along the way. Some, however, are not so sure that the massively parallel designs will find a place in the commercial market.

Academic parallel-processing projects will likely spawn few commercial systems directly because researchers do not typically consider manufacturing and servicing tradeoffs, believes R. David Lowry, market development manager for Denelcor. He notes that commercial-product development teams generally start off a project by weighing the profit and loss impacts of design decisions.

"A university doesn't have to worry about that, so there are often many built-in dead ends in projects," Lowry says. "This is not to say the value of their research is diminished. It does, however, make it very difficult for someone to reinvent the system to make it a commercial product."

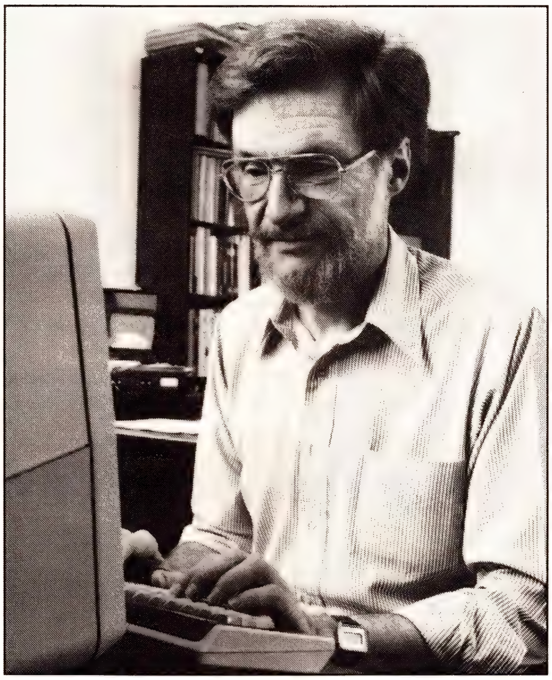
"I have never seen a successful commercial architecture derived from a university project," chimes in Norman Weizer, a senior consultant at Arthur D. Little Inc., a market-research firm. "Except for raw signal processing, the massively parallel market has a history of failure," he observes. Weizer believes that the problem of developing algorithms and software that can properly segment tasks to take advantage of the power of a massively parallel design will create a heavy drag on their use for commercial applications, at least in the near term (see "Software is a hard nut to crack," p. 38).

Birth announcement. Despite the doubters, the first of what could be a new university-spawned breed of parallel systems has already been announced. Intel Corp. plans to begin commercial shipments in June of a system called the Cosmic Cube, based on a parallel architecture that was developed at the California Institute of Technology with funding from the DOE and others [*ElectronicsWeek,* Feb. 11, 1985, p. 15]. Known as the iPSC, the system sold by Intel's Scientific Computers group, in Beaverton, Ore., will link as many as 128 8-MHz 80286/80287-based processors in a $500,000 package to achieve computing speeds up to 10 million floating-point operations per second.

Intel officials acknowledge that a scarcity of application software and tools could present problems initially, but they are positioning the machine as a scientific tool that can be used in the development of massively parallel algorithms, languages, and associated software tools. Paul G. Wiley, iPSC market segment manager, foresees a total available iPSC market for at least 100 machines, and probably more. The Intel group required about a year to refine the CalTech design for commercial manufacturability and field service support.

Other commercial systems based on university work may not be far behind. In Acton, Mass., for example, startup Alliant Computer Systems Corp. plans by mid-year to introduce a parallel system that is conceptually based on work done by University of Illinois researcher David Kuck. Alliant president Ronald H. Gruner is tight-lipped about product details, but notes that his firm has had consulting ties for the past three years with Kuck, whose credentials include work on the one-of-a-kind massively parallel Illiac IV machine, delivered to the National Aeronautics and Space Administration under federal contract in 1972.

Automatic restructuring. The forthcoming Alliant system is expected to make particular use of Kuck's efforts in developing software to automatically restructure existing Fortran programs to run on architectures including massively parallel designs. Among other activities, the Illinois researcher heads a six-year-old private company known as Kuck & Associates Inc. that will soon begin sales of a source-to-source restructuring software package for use with current and future generation commercial supercomputers [*Electronics-Week,* March 11, 1985, p. 44].



Contributor. A commercial parallel system will likely use David Kuck's work in software restructuring Fortran.

The software, known as KAP (for Kuck Accelerator Package), is an outgrowth of the Paraphrase software project at the University of Illinois, which is linked to the school's Cedar hardware effort to produce a massively parallel machine. The Cedar project, in fact, is one that has benefited handsomely from recent increased federal parallel-architecture research support. Until now, the effort has been funded at about $500,000 to $750,000 annually from a variety of federal and commercial sources.

But in February, the University of Illinois announced it has received grants totaling $9 million from the DOE and the NSF that will be used by the school's newly formed Center for Supercomputing Research and Development to build a hardware implementation of a Cedar machine. In all, according to Kuck, the center's director, government and industry support for the project is expected to total about $30 million over the next five years.

The center will build its own central switch and other key components for handling data transfer, interprocessor communication, and process synchronization in the massively parallel Cedar design. Interestingly, the school plans to purchase the hardware for the processor from Alliant.

By year-end, the Kuck group plans to have running a 16-processor prototype linking two clusters of eight processors each to be supplied by the Massachusetts startup. The Illinois researchers then plan to double the number of processors yearly to produce a 128-processor Cedar system by early 1989, with a 1,024-processor system possible by 1992. The hope is for commercialization of Cedar.

Kuck declines to provide details on the type or the speed of processors to be employed in the Alliant-supplied eight-processor subassemblies for fear of revealing too much about Alliant's commercial product plans. But he does indicate that Cedar system performance is now expected to surpass that of previously announced estimates that called for 2.5 megaflops per processor in the Cedar design. "Given the current advances in microelectronics, it is not unreasonable to expect a 1,024-processor Cedar which can yield a sustained computational rate of one teraflops," says a recent Illinois document discussing the effort.

In Darpa's SCI program, about a half dozen projects aimed primarily at MIMD multiprocessor architectures have already been funded, and the agency is currently evaluating what one official calls "an extraordinary number of good proposals" in competition for additional awards later this year.

Already-funded projects include the following:

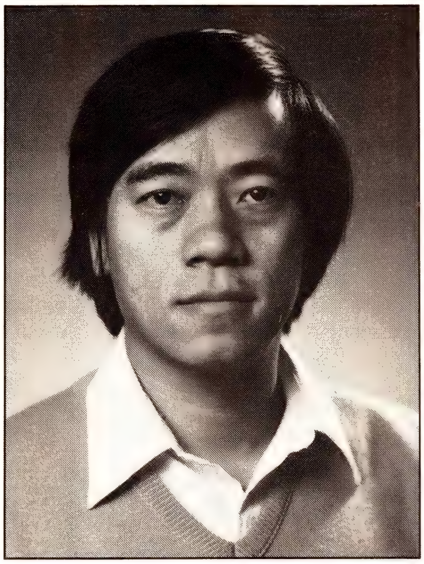
■ *The Connection Machine.* Being developed at Thinking Machines Corp., a Cambridge startup formed by Massachusetts Institute of Technology researchers, the Connection Machine is a fine-grained architecture based on simple bit-stream processors. Programming will be done with a Lisp machine that will serve as the system host. By year-end, Thinking Machines plans to deliver a 64,000-processor prototype Connection Machine to Darpa that will be able to perform 1 billion instructions per second [*ElectronicsWeek,* March 18, 1985, p. 48].

The prototype will be built using 10,000-gate CMOS arrays. Fully functional processor chips, each housing 16 processors and a commmunications router, have already been demonstrated. The prototype is viewed as a stepping stone to a 1 million-processor model based on custom very large-scale integrated circuitry.

- *The Dataflow Emulation Facility.* Under development by MIT's Laboratory for Computer Science, this project will employ up to 64 commercially available Lisp machines connected by a high-bandwidth low-latency switching network for use in emulating a variety of multiprocessor designs, including tagged-token data-flow architectures. A small-scale hardware and software system has already been completed.
- *Dado.* One of two tree-structured multiprocessor architecture projects at Columbia University, Dado is a coarse-grain tree architecture designed for parallel processing in a production-rule environment. The project includes design, test, and evaluation of custom VLSI chips and printed-circuit boards, as well as development of supporting software and implementation of higher-level programming languages.
- *Non-von.* The second Columbia project, Non-von (short for non-von Neumann), is a fine-grain binary tree design that has as its goal the exploration of "applications of very large-scale parallelism to a wide range of tasks, but with special emphasis on artificial intelligence and other symbolic processing tasks," says David Elliot Shaw, director of the project. Already completed is a Non-von prototype that relies on a 32-bit microprocessor to control the execution of 63 smaller processing elements [*ElectronicsWeek,* April 1, 1985, p. 40].
- *The Supercomputer Workbench.* One of two projects at Carnegie-Mellon University, it will supply the operating system and software for a general-purpose 32- or 64-processor machine, to be supplied by a commercial vendor, for multiprocessor simulations, algorithm studies, and the like.
- *The Programmable Systolic Array Project.* In the other Carnegie-Mellon effort, researchers hope by the end of May to have running a 10-processor system called the Warp (see figure). It will use commercially available processing chips from Weitek Corp. working on a Multibus with a 68010-based host [*ElectronicsWeek,* Aug. 20, 1984, p. 24].

This machine is expected to hit 100-megaflops speeds and in turn will be the basis for another 10-processor prototype that will use a VMEbus and a 68020-based host to go three times faster. Working versions of that system, to be built by an industrial vendor, will be delivered to Darpa by early next year, according to CMU researcher Kung.

Later plans call for a Warp 2 design that will rely on a custom VLSI circuit to replace most of the 180 glue-logic chips in the current Warp, enabling a board size three to four times smaller than the original. Warp will be suitable for rapid computations of complex mathematical operations such as fast Fourier transform and convolution operators. ☐


Optimistic. "Anybody who is serious about building machines can probably get some [federal] funds now," says CMU's H.T. Kung.

SOFTWARE IS A HARD NUT TO CRACK

After 30 years of developing sequential code for conventional von-Neumann-style architectures, computer scientists and programmers now face the task of developing algorithms, compilers, and other software tools that are needed to program in parallel. The goal is to take advantage of the coming generation of massively parallel computers.

"There are reasonable prospects that our architecture could be a commercial product in a few years, and easily by the end of the decade. Commercialization is a function of how effectively we solve our problems, and the issue is software," says Lawrence Snyder, a University of Washington researcher who heads a parallel-architecture project known as Blue Chip.

"If there's any area of concern with the Non-von, it probably is the area of software and the ease of implementing various kinds of algorithms," concedes David Elliot Shaw, director of the Non-von parallel-architecture project at Columbia University.

But though most researchers acknowledge the magnitude of the task, they are optimistic that the software problem can be ultimately overcome. "The fundamental techniques [of parallel programming] are not very difficult. You've just got to sit there and create that code. It just takes people working hard," observes Geoffrey Fox, one of two principal researchers on the Cosmic Cube project at the California Institute of Technology.

Since mechanisms do not yet exist for automatically distributing programs over the Cosmic Cube's multiple-processor nodes, programmers must segment the tasks themselves. On the average, writing code for concurrent machines takes about 20% longer than writing code for a comparable application on a sequential machine, Fox estimates. He expects that differential to drop as programmers gain more experience and as tool libraries and new languages are developed.

By soliciting scientists from a number of different university departments to write code for the Cosmic Cube, Fox says Caltech has already "demonstrated that these machines can actually be used in a wide variety of fields. We currently have about 20 programs running on our machine." Application areas include high-energy physics, astrophysics, quantum chemistry, fluid mechanics, structural mechanics, and seismology. The efficiency of these programs averages around 85%, meaning that a 64-node Cosmic Cube would execute programs about 54 times faster than a comparable single-processor machine. –W.R.I.

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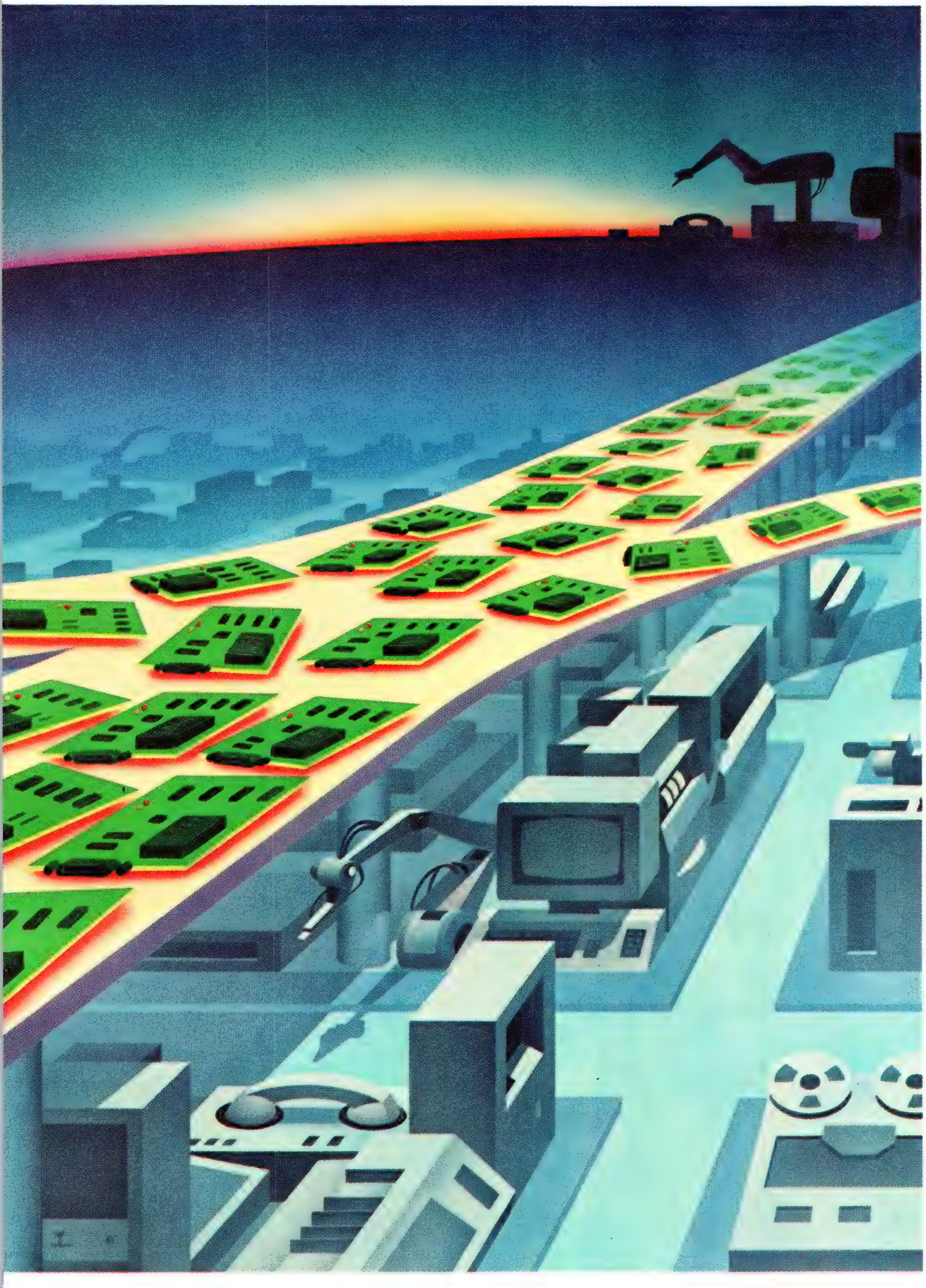

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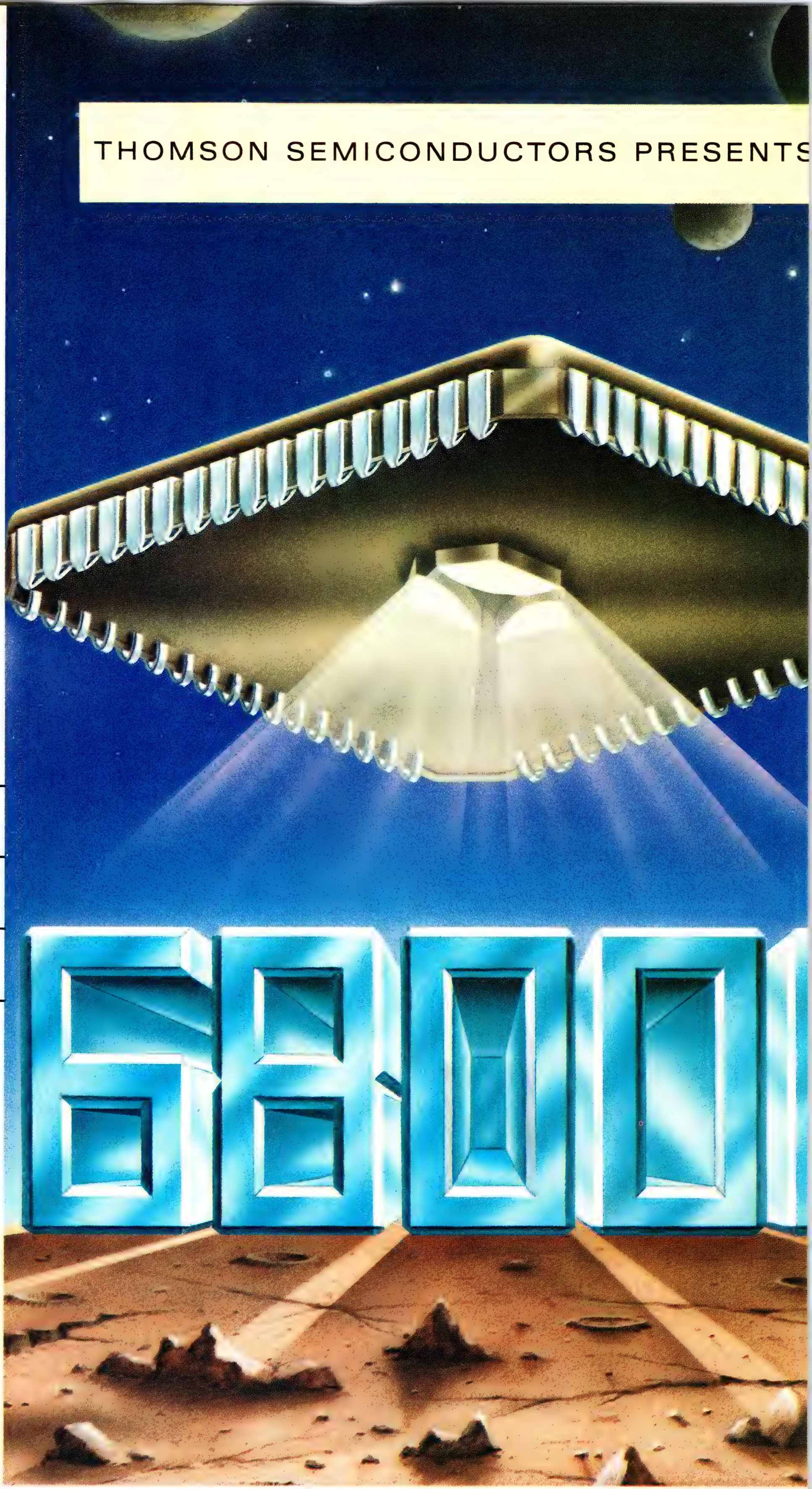

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EF 68000 - 12.5 MHz	X	X	X	Q1	Q1	Q1	Q2	Q2	Q2	Q2
EF 68000 - 16 MHz	Q2	Q2	Q4	Q2	Q4	Q4	Q4			
EF 68008 - 8 MHz	X	X	Q4		X	X				
EF 68008 - 10 MHz	X	X	Q4		X	X				
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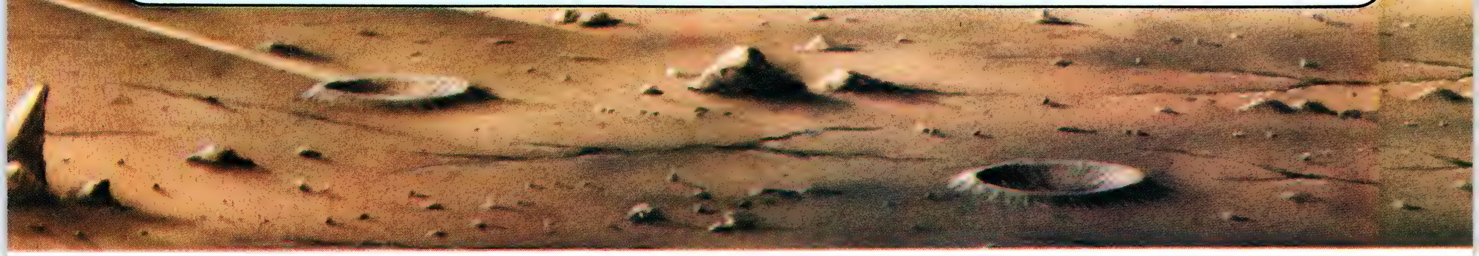

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The merger of the two disk-drive manufacturers could produce a stronger presence in a highly competitive market

San Jose, Calif.

When companies that compete in similar markets decide to merge, the resulting combination sometimes proves less than beneficial as unreconcilable differences in philosophy and products develop. But the recent marriage of Priam Corp. and Vertex Peripherals Corp. could be one in which the whole is greater than the sum of its parts.

Although Priam and Vertex were both suppliers of high-performance high-capacity Winchester disk drives, there the similarity ended. Vertex, started in 1982, was formed to exploit ways of packing more performance into 5¼-in. drives. Priam's strength was in the older 8- and 14-in. technologies. When they merged late in February, they formed a company that approached the disk-drive market like Jack Spratt and his wife at a banquet.

Because there was so little overlap in product lines, the merger won quick approval from stockholders, and industry seers nodded in agreement. "I believe that the Vertex-Priam merger will be a good one," notes disk-drive-market research guru James Porter, president of Disk/Trend in Mountain View, Calif. "Usually I don't think that much of mergers [since] most are abominations, but this one looks good."

Adds Nancy Bendig, a research analyst with L.F. Rothschild, Unterberg, Towbin, in New York, "The combined efforts of the two companies should provide improved insulation against current uncertainties in the market."

Not everyone at the two firms survived the merger, though. Because of duplication in some managerial functions, about 150 workers are being laid off this month. Those who remain are among friends, however, as many of them have worked together before, some Vertex employees at Priam and vice versa.

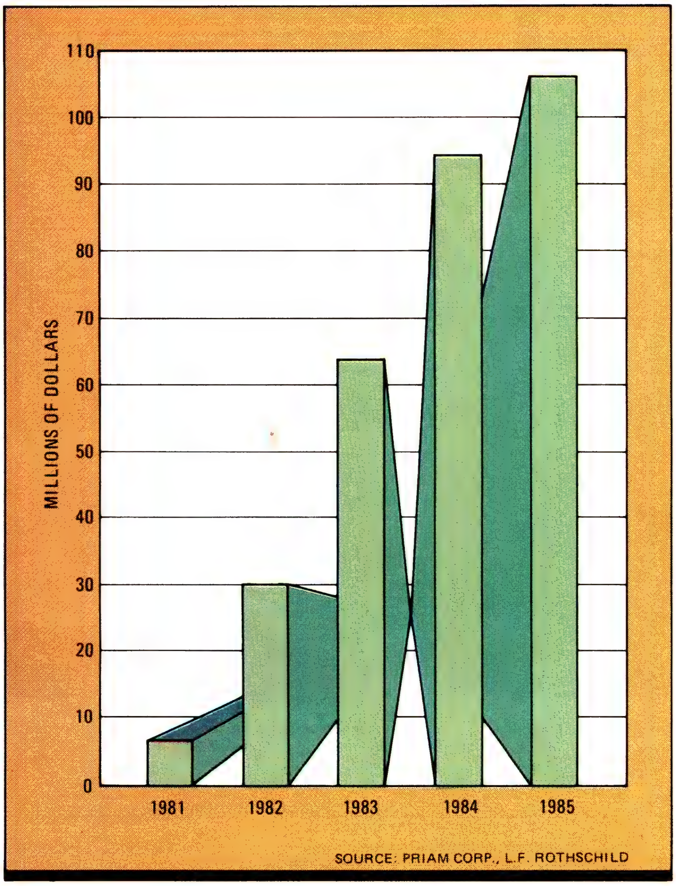
The merger itself came as no surprise; talks had started in February of 1984, later cooled, and then resumed in earnest in August. Shortly after that, work was started to integrate both firms' engineering teams. The completed merger in February largely finished the job of melding the two firms. (Under terms of the agreement, Priam issued 7.1 million shares of new stock to Vertex shareholders; the transaction was worth about $45 million.)

"The spirit of cooperation has been very high," says Joe T. Booker, formerly president of Vertex and now president of the newly restructured Priam. (Former Priam president William J. Schroeder moved up to become chairman and chief executive officer.) "There is some anxiety though, I must admit. We're having to react to that."

Booker downplays the problem of layoffs as he looks ahead to running a much larger corporation. "Clearly, the biggest change is going to be managing many more products."

Strategic. James Adkisson, who becomes vice president of sales and marketing at the new firm, says the combined strengths of the two companies will give the new Priam an edge in the increasingly competitive disk-drive market. Porter of Disk/Trend believes the new firm "looks fairly well positioned" for today's market, since the combination "gives Priam an excellent 5¼-in. line, which is what they missed."

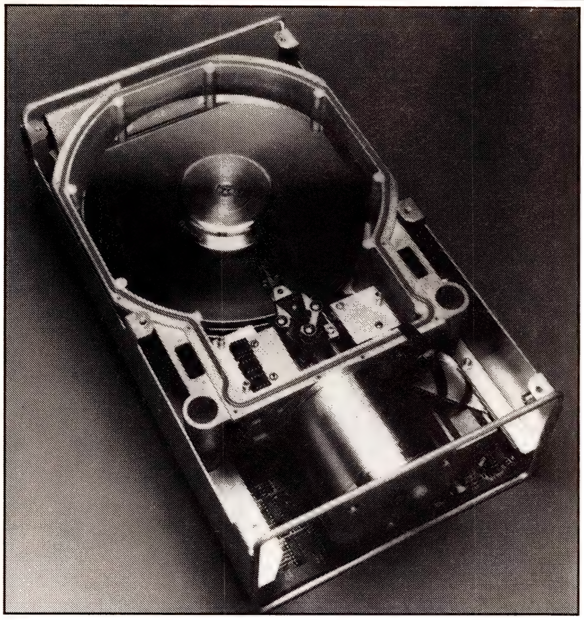
Bendig of Rothschild agrees. "The Vertex product line fills a gap in Priam's family of products."



SOURCE: PRIAM CORP., L.F. ROTHSCHILD

Advancing. Priam Corp. has grown rapidly since its start in 1981. With Vertex Peripherals Corp., sales could hit $106 million this year.

Aides. Joe T. Booker (top left) became Priam president, with William Schroeder (top right) chairman, Jim Adkisson (bottom left) sales vice president, and Theodore Scooros, marketing manager.



Declining. With demand slipping for such products as this 8-in. drive, Priam Corp. sought Vertex Peripherals Corp. and its low-end Winchesters.

Vertex has made much of a relatively small investment. As of March 1984, Vertex had raised some $15.4 million in venture capital. By the time of the merger, it had $130 million in contractual backlog, of which $70 million to $100 million represented "real" orders, says Theodore Scooros, marketing manager for the 5¼-in. line.

What Vertex needed to support its expected growth was an influx of investment. According to Scooros, Vertex shipped about 4,000 units in March and, with major customers such as Hewlett-Packard Co. and IBM Corp., it expects to double that rate by midyear. To meet its growth projections, however, Vertex needed a $10 million to $15 million infusion of cash. It also needed an alternative source of financing because, he says, "given what venture markets are right now, they're absolutely terrible [and] not very palatable."

Good match. Priam, with $45 million in cash assets, was a proper match. The Priam line of the business is currently shipping at a rate of about 3,000 units per month. The combined annual run rate is about $120 million a year, with Vertex accounting for about $50 million of that.

Although revenues for Priam have increased dramatically, from just under $6 million in fiscal 1981 to an estimated $106 million for fiscal 1985, profits have bounced around. The firm posted a loss of $7.3 million in its second fiscal quarter. For all of fiscal 1985, the company could lose about $11 million compared with earnings of $9.35 million attained in fiscal 1984. Still, Adkisson expects Priam to accomplish profitability by the first quarter of fiscal 1986.

This doesn't mean that success is assured simply because of the merger. Says Bendig of Rothschild, "The industry is characterized by short product life cycles and intense price competition." And though "the most vigorous competition will be domestic," says Porter of Disk/Trend—citing such firms as Micropolis Corp. and Maxtor Corp.—Fujitsu Ltd., the main Japanese player, "will be a tough competitor."

Scooros concedes that Fujitsu usually "has a fantastic reputation for quality," though he contends that the Fujitsu design is not mature. With a product designed just for original-equipment manufacturers, he maintains, Fujitsu comes out "looking like yet another American company" in quality.

Entrepreneurial. Scooros maintains that Priam still has the "ability to be more nimble. There's still a good deal of entrepreneurial spirit and that's what gets things done."

Bendig of Rothschild points out that Priam's expertise in making high-capacity high-performance 14- and 8-in. Winchester disk drives and its attempt to broaden its product portfolio with new advanced 8- and 5¼-in. drives will be leveraged by Vertex's success in the midrange 5¼-in.-drive market. "The older 14- and 8-in. line is becoming less important" in the marketplace, she says, but the "slack will be picked up by Vertex." In addition, Priam's highly automated production facilities "are not fully utilized currently and can be used to increase Vertex's throughput."

While the merger's expense and efforts to consolidate and streamline operations "could have an adverse impact on short-term profitability," she cautions, "the combined company should be well positioned for long-term growth."

There are signs of a shakeout in the lower-performance echelons of the disk-drive business, Scooros says. As for the high-end part, "I think you'll see more consolidation than shakeout."

Adkisson is sure that Priam will stay with its U.S. manufacturing base because the cost structure of the high-end of the disk-drive market is not very labor-intensive. He estimates that labor accounts for only about 5% of the cost of the company's drives, so there would be no great cost savings to move production overseas. *–Eve Bennett*

BOTTOM LINES

Raytheon sets up venture group. Raytheon Co., a $6 billion company with interests in electronics and aircraft products, among others, has set up a new enterprise to direct and manage venture investments in young companies in business areas related to its present and future businesses. "Our objective is to share in emerging technologies that are best participated in through investments in young entrepreneurial companies," said Raytheon chairman Thomas L. Phillips. The new venture group will work with Raytheon's strategic planning staff. "Where we identify growth potential with useful links to Raytheon's own products and fields of technologies, we plan to take appropriate equity positions in those startup firms," Phillips added.

Japanese chip makers add to share. Japanese semiconductor manufacturers' share of the worldwide merchant chip market grew to 42% in 1984 from 37.3% in 1983 and 33.9% in 1982, according to research analyst Michael A. Gumport of Paine Webber Inc. In his latest study of the market, Gumport says U.S. chip makers' market share slid to 51.8% in 1984 from 55.4% in 1983 and 57.4% in 1982. "It now appears reasonable to anticipate the Japanese will surpass U.S. merchant chip makers in size in 1988," he projects. Japanese producers "gained share in all major categories last year," Gumport's report continues. "They actually surpassed the U.S. merchants in 1984 in two of the four major product lines: linear circuits and discrete devices." The developed, free-world merchant chip industry grew 47.4% in 1984 to $26 billion, he says. "Our estimates indicate the U.S. merchant manufacturers grew 38% in 1984, the Japanese grew 66%, the Europeans grew 26%, and U.S. captives grew roughly 38%."

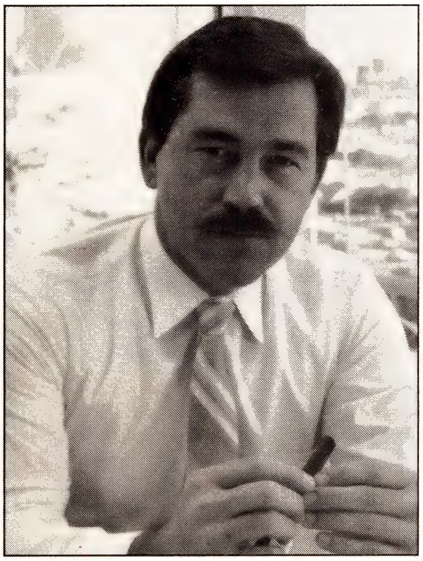
Ducommun agrees to buy Thiem. Ducommun Inc. has signed a letter of intent to acquire Thiem Industries, a privately held Torrance, Calif., firm that makes precision metal components for aerospace and commercial electronics applications. A definitive agreement is expected to be signed by the middle of May. The proposed transaction is valued at about $21 million.

Altera closes third-round financing. Altera Corp., a maker of erasable programmable logic devices, raised $8.4 million in a third round of equity financing. This brings to $15.7 million the amount raised since its founding 19 months ago. The Santa Clara, Calif., firm says it will use the funds for research and development and market development.

PLAYERS

WINSOR GUIDES INFOMART THROUGH ROUGH WEATHER

Earlier trade-show adventures at TI taught firm's president how to handle a cold start and a bumpy ride when gearing up



Recruiter. As head of the Infomart center in Dallas, William M. Winsor has already snared tenants such as IBM, Microsoft, and AT&T.

Dallas

Without much doubt, previous trade-show experiences taught William M. Winsor what to expect when opening Infomart, the world's largest trade mart for computer technologies. The $97 million center here is intended to provide a permanent show environment and the greatest one-stop-shopping facility for computer buyers.

Prior to becoming president and general manager of Infomart, Winsor had seen plenty while managing trade shows for Texas Instruments Inc. in the 1970s—including the time a truckload of computer equipment smashed into a bridge on the way to a major conference. So he wasn't caught off guard when a Texas "blue northerner" cold front—with temperatures dropping a degree a minute—hit just days before Infomart was to officially open in January, hosting 14,000 at a software show.

Though the wintry blast didn't damage the glass-enclosed seven-story arching structure (or reduce the crowd), it did hamper the last-minute rush to finish the mart's floor. But Winsor believes the scramble to ready Infomart, along with the skeptics who still question the industry-mart concept, have created a special bond between the center and its tenants, which include the likes of IBM, AT&T, Xerox, Burroughs, Microsoft, and NCR. To date, just under 50% of the 1.5-million-ft^2 building has been leased, with arrangements being made for 15% to 25% more.

"We had no empirical data to draw on; we had no templates to draw Infomart from. So, much of what we have done has been in uncharted waters," says the native of Refugio, Texas, who was named the mart's president three years ago by Dallas real-estate magnate Trammell Crow.

Crow, a self-made billionaire, has built a corner of his real estate empire on creating industry-targeted trade marts in his well-known Dallas Market Center complex of buildings. As part of the Center, Infomart is an attempt to change the way business computers are sold by coupling permanent showrooms with information-processing trade shows. Plans call for other Infomart centers to be established in the U.S. and in other parts of the world, based on the basic trade-mart setup used for the center in Dallas.

Winsor was tapped by Crow to head up the Infomart effort because of his experience as TI's merchandising manager of worldwide exhibits, trade shows, and point-of-purchase advertising for all products. Now, Winsor, who received a BS in communications from Southwest Texas State University in 1967, is helping to spread Crow's computer-mart concept.

In New York, Crow is in a joint venture with Tishman Speyer Properties Inc. to open a 2.4-million-ft^2 market center at 42nd Street and Eighth Avenue. The developer has options on two pieces of land in Los Angeles for a similar technology trade mart. As part of his role, Winsor has been flying monthly to Paris to ready a European version of Infomart, which is slated to open its doors the first quarter of 1987.

Information gap. The computer technology marts are an attempt to fill an information void that Winsor says is widening between industry trade shows and a growing but diverse customer base. "One of the lacking dimensions of a trade show is that there is no real opportunity for people to gain a full understanding of products on the trade-show floor in a three- or four-day metered environment. The other problem is the need for users to have access to technology, as opposed to waiting for events and the caravan of companies."

Since January's opening, the mart has moved to host more vertical trade shows, which then allows computer users in targeted industries to visit Infomart's tenants located on the upper levels of the center. "Originally, we had assumed the exhibiting base would be predominantly manufacturers of hardware and general-purpose software," notes Winsor. "But recently we have seen manufacturers starting to bring in their added-value resellers to be coresident during these events."

Confident that Infomart has secured enough major suppliers to succeed, Winsor does admit that the concept is still in a delicate stage. "We are really in the white water, and we must stay ultrasensitive to both the needs of tenants and visiting computer buyers. Without one, you lose half the equation for success," he says. *–J. Robert Lineback*

SUTCLIFFE SEES CLEAN PATH IN CHIP-EQUIPMENT MARKET

Santa Clara, Calif.

Though he's a 30-year veteran in the electronics field, at 59 Charles H. Sutcliffe has not tired of working with startups. A founder of Standard Microsystems Corp., located in Hauppauge, N.Y., and Four-Phase Systems Inc., a subsidiary of Motorola Inc. in Cupertino, Calif., Sutcliffe has recently been working with several other startups through his consulting business, Silicon Valley Management.

Now, he has chosen to go full-time as president and chief executive officer with one of them, a semiconductor equipment firm called Benzing Technologies Inc., as it prepares to launch its first product and go after second-round financing.

After completing a PhD in physics in 1953 at the University of Pennsylvania, Sutcliffe mixed work with some of the more prominent electronics companies, including Ford-Philco Corp., Fairchild Camera & Instrument Corp., and Varian Associates Inc., with his startup endeavors. Among his experiences, he did a seven-year hitch with Applied Materials Inc., where he worked with Walter C. Benzing, father of David W. Benzing and Jeffrey C. Benzing, founders of Benzing Technologies.

Sutcliffe says he moved out of consulting and back into a corporate position with Benzing because he "was enthused by their products and their opportunity." The firm plans to introduce the first of its products, Autoclean 10, at the Semicon/West trade show that is scheduled to be held May 21-23 in San Mateo, Calif.

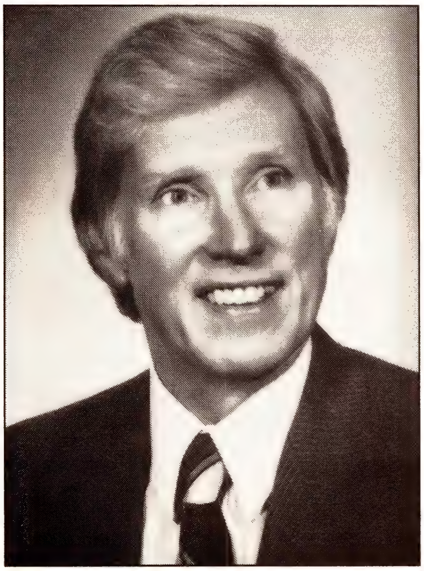
The product is an *in situ* cleaning machine for low-pressure chemical-vapor-deposition tubes, which he says will reduce particulate contamination of the long quartz tubes used in batch wafer processing. The device's arm inserts an electrode structure into the tube and makes a plasma, which is used to clean off the inside of the tube. Because tubes don't have to be moved and cooled as in current cleaning methods, Sutcliffe says the product will also cut cleaning time even as it reduces the danger of tube breakage.

Growing market. One reason Sutcliffe is so optimistic about this company is that the semiconductor equipment field is large and growing rapidly. "It's growing at a faster rate than the semiconductor market," he claims. Moreover, compared to the semiconductor market, he says "the semiconductor equipment business is less structured, less dominated by one company." Since customers are used to dealing with several suppliers and change them frequently, Sutcliffe reasons that a new company has an inroad.

He believes there is strong competition in semiconductor-manufacturing technology, however, from other young companies and from larger, established companies such as Varian that have moved into the semiconductor equipment market. So, for an extra edge, his company made arrangements with Kanematsu Semiconductor Corp. of Tokyo for over $1 million in initial financing.

In addition to the funds, Sutcliffe says that this agreement gives Benzing "rapid access to the Japanese market and Japanese technology." Because 40% of the worldwide semiconductor market is in Japan, he says that it was important to go there early to "market and sell more effectively there."

With Autoclean 10 ready for market, Sutcliffe is looking forward to second-round financing to support development of products with more general applications. These products will be based on the Benzing brothers' expertise in plasma technology. *–Eve Bennett*



Starter-upper. Charles H. Sutcliffe, founder of two electronics companies, takes on a new startup role with Benzing Technologies.

HANNA OF DATAPORT MAKES A SWEDISH CONNECTION

Tring, England

Herbert F. Hanna worked for two of the biggest companies in the electronics industry for more than 24 years—17 with IBM Corp. and 7 with ITT (Europe) Inc.—before deciding to try something completely different. Last November, he became managing director of Dataport Microsystems Ltd., a small manufacturer here of portable data-capture equipment.

Hanna clearly relishes the change. Within the past month, he pulled off a long-planned coup when Dataport, which employs 100 and had over $2.68 million in sales in 1984, was sold by its parent, Unitech Ltd., to Parcon AB, a Swedish systems company. The company, based in Helsingborg, grossed $43 million last year and already controls more than a dozen data-capture companies worldwide. Jubilant about the sale, Hanna points out that "this dramatically accelerates our plan to expand into international marketing."

System 3 seller. Of Irish-American stock, Hanna, 49, earned a BA degree in commerce from University College, in Dublin. Then he joined IBM, ending up as general manager of Basic Systems—Europe.

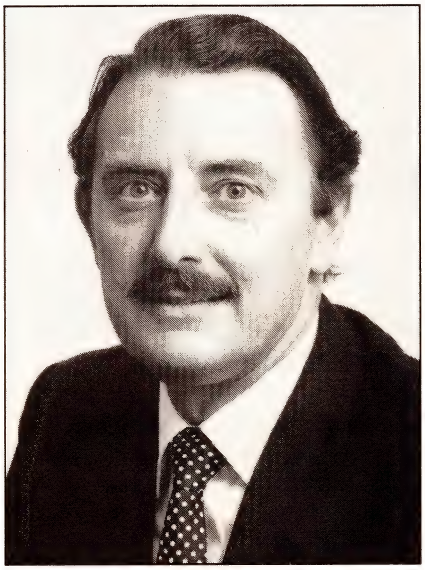
"I spent 17 years with IBM, changing my job every three years. You are being pushed up all the time," he remarks. Of his time with Big Blue, he is most proud of having restructured IBM's European marketing operations to address the rapidly growing number of first-time computer users opened up by IBM's introduction of its first small-scale business computer, the System 3. "Too much business was coming from existing accounts, and marketing was structured to serve these accounts," he says. So Hanna created the General Systems Division to look for new business, contributing to the success of System 3 in Europe.

Yet as Hanna climbed higher up the IBM management ladder, his frustration grew. "I found I was less and less able to directly influence events—hardware developments and the like." So in 1977, Hanna joined ITT (Europe) as video-systems director, charged with guiding ITT into the small-business computer market in Europe. Later, he became deputy managing director of ITT Consumer Products (UK) Ltd.

Last November, Hanna was approached by Peter Curry, founder and director of Unitech, who had been trained at Oxford and Harvard Business School. He and his brother John have built Unitech into a distribution-to-manufacturing electronics conglomerate that does $188 million in sales. Dataport was formed when two earlier Unitech acquisitions—UCSL Microsystems and Data Recognition, a maker of character-recognition gear—were put together.

Fast laner. The company makes, sells, and services portable data-capture gear for sales-order entry, production control, and any application needing two-way communication with a remote computer. But the company was not prospering. Hanna diagnosed two fundamental problems: Dataport needed to innovate faster or "run like hell" as he puts it, and the company needed international sales outlets. "Unless you have a larger market than the UK, you can forget it," he notes wryly.

Hanna still acts on the parting advice of an IBM associate. Edwin Nixon, managing director of IBM (UK) Ltd., told him that when joining a company, wait a few months before doing anything, and never do something because it worked at IBM. So when Hanna joined Dataport, he asked all staff members for their opinions on what was wrong with the company before he took action. It became clear that different departments, such as sales, marketing, and production, were not working together. Now they are working as a team, he says. And his staff reports that he keeps an open door. *–Kevin Smith*



Salesman. Herbert F. Hanna, of Britain's Dataport Microsystems, arranged the sale of his company to Parcon AB of Sweden.

NEC NEWSCOPE

V-SERIES CMOS MICROPROCESSORS

NEC has unveiled the V-Series, a superior species of 16/32-bit CMOS microprocessors.

Ready for your evaluation are V20 and V30 16-bit microprocessors. The V20 has an 8-bit external bus, while the V30 is a full 16-bit machine. A powerful set of 101 instructions, dual data bus architecture and many other design refinements make these chips 50% faster than our 16-bit NMOS processors. Also power consumption is reduced by 70%.

The V20/V30 are supported by a full range of CMOS peripherals. A CMOS coprocessor (Floating Point Processor) is under development. The software package includes a proprietary real time OS, and development tools include an in-circuit emulator, relocatable assembler, Pascal and C compilers.

Shortly, peripherals hop on board. The V40 and V50 feature basic peripheral functions integrated on V20 and V30 silicon. The V25, complete with ROM, RAM, I/O port and serial interface, is a powerful processor for portable products.

The V20~V50 give you higher performance utilizing current software developed for our NMOS micros.

The V60 and V70 are 32-bit microprocessors with mainframe power. Features include an on-chip memory management unit and 4.3-gigabyte virtual memory.

The V-Series is second-sourced by Zilog, Inc.

C&C
Computers and Communications

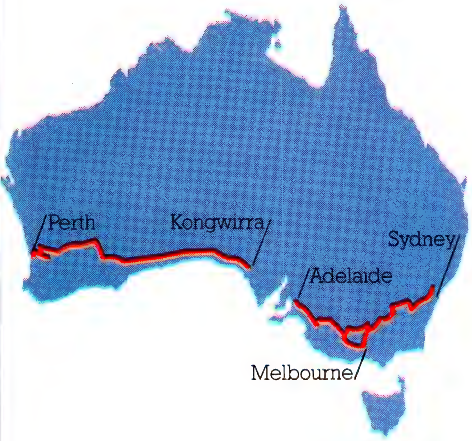
NUMBER 132

LARGE DIGITAL MICROWAVE LINK TO AUSTRALIA

NEC will supply Australia with a third large-capacity digital microwave system. Based on NEC's advanced 500-Series, it will span a total distance of 2,000km between Perth and Kongwirra in 52 hops.

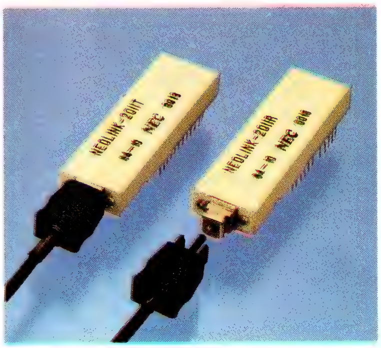
This new link will use NEC's 6.7GHz 140MB equipment with a capacity of 3,840 telephone channels, currently the largest available. The equipment is specially designed to operate in high temperatures, which top 55°C in the desert regions during the summer. Numerous advanced features, including adaptive and transversal equalizers and hitless switchover equipment, are incorporated to assure high speech quality.

The two previously supplied digital links are the 800km Sydney-Melbourne system and 650km Melbourne-Adelaide system. These also feature NEC's 500-Series 140MB equipment and accommodate 11,520 telephone channels.



NEOLINK™-2011 FOR HIGH-SPEED FIBER OPTIC LANs

Our new NEOLINK-2011, a pair of optical transmitter and receiver modules, enables the cost-efficient formation of reliable high-speed LANs without using LDs and APDs.



The NEOLINK-2011 combines a 1.3μm high-speed LED and PIN-PD. This ideal configuration takes maximum advantage of the low-loss, low-dispersion regions of graded index fibers.

The surface-emitting LED features 1.8ns rise and fall times and requires no thermoelectric cooling device. A newly-developed monolithic IC in the receiver incorporates AGC and line failure detection circuits and secures a 15 dB dynamic range. As a result, dependable high-speed digital transmission of up to 200Mb/s over a maximum distance of 3km is possible.

NEC's NEOLINK-2011 mates with graded index fibers of diverse core diameters. Interfacing with other systems is made easy by ECL level input/output and minimal restrictions on data formats.

The 9.5mm-high DIP design can be mounted directly on PC boards and runs on a −5.2V DC power supply. The built-in AGC eliminates circuit adjustments.

A low-profile, low-loss connector, with vibration-resistant lock, provides convenient snap-on connection.

NEC also supplies optical switches, couplers, fibers and all other components for LAN systems.

NEOLINK is a trademark of NEC Corporation.

THAILAND SELECTS MORE NEAX61 DIGITAL SWITCHING SYSTEMS

The Telephone Organization of Thailand (TOT) has again chosen the NEAX61 digital switching system. This time as the core of its fifth five-year telecommunications expansion project.

The contracts involve more than 870,000 subscriber lines (except for tandem switches) to expand the present digital network with new exchanges, including remote and cabin switches. When these new exchanges begin service, over two million subscriber lines will be served by NEC systems in Thailand.

The digital telephone network in Thailand features NCOM—NEC's Computerized Operation and Maintenance System. Incorporating the best of NEC's long experience and integrated computers and communications (C & C) technologies, NCOM provides comprehensive support using computers for the digital network—an important step towards the goal of ISDN.

NEC
NEC Corporation
Tokyo, Japan

How to keep from the electronic war.

being a casualty in

Is the electronics industry going the way of other industries?

There used to be 600 automobile manufacturers in the United States. Today there are four.

Once there was a brewery in every city. Today most of them are gone.

Today there are 200 personal computer manufacturers. How many will there be tomorrow?

The shakeout has started. Yesterday's darlings are today's disasters. Many companies have seen their reputations shattered. And the casualties continue to mount as competition intensifies.

Technology on a rampage.

Today's rampaging technology has done in many of yesterday's heros.

Such was the case when the 16 bit technology wiped out the computer companies still working with 8 bit technology. Or when the marketplace gave the VCR the nod over the videodisc.

Some say PBX technology will replace local area networks. And CMOS will overrun NMOS. And laser optical networks will challenge satellites.

Where do I get my Edsel serviced?

Customers are concerned. Nobody wants an orphan. Who wants to be stuck with a product without service, without spare parts, without product enhancements?

What customers do want in today's fast-changing marketplace are "credentials". They want assurance that the company they're buying from will be around after the smoke clears.

Survival requires better decisions on such things as technology, positioning, marketing and distribution. Decisions that have to take into consideration not only other U.S. companies, but global competitors as well.

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MEMORIES

ONE-MEGABIT EPROMs INVADE DISK TERRITORY

A NEW HIGH IN NONVOLATILE CHIP DENSITY PROVIDES ENOUGH STORAGE CAPACITY TO ELIMINATE THE DISK IN SOME SYSTEMS

A 1-Mb erasable progammable read-only memory being introduced by Advanced Micro Devices next month could make significant inroads on the disk-drive market. The EPROM combines a new high in storage capacity with nonvolatility and sufficient speed, thus making it an attractive alternative to disk storage in many applications.

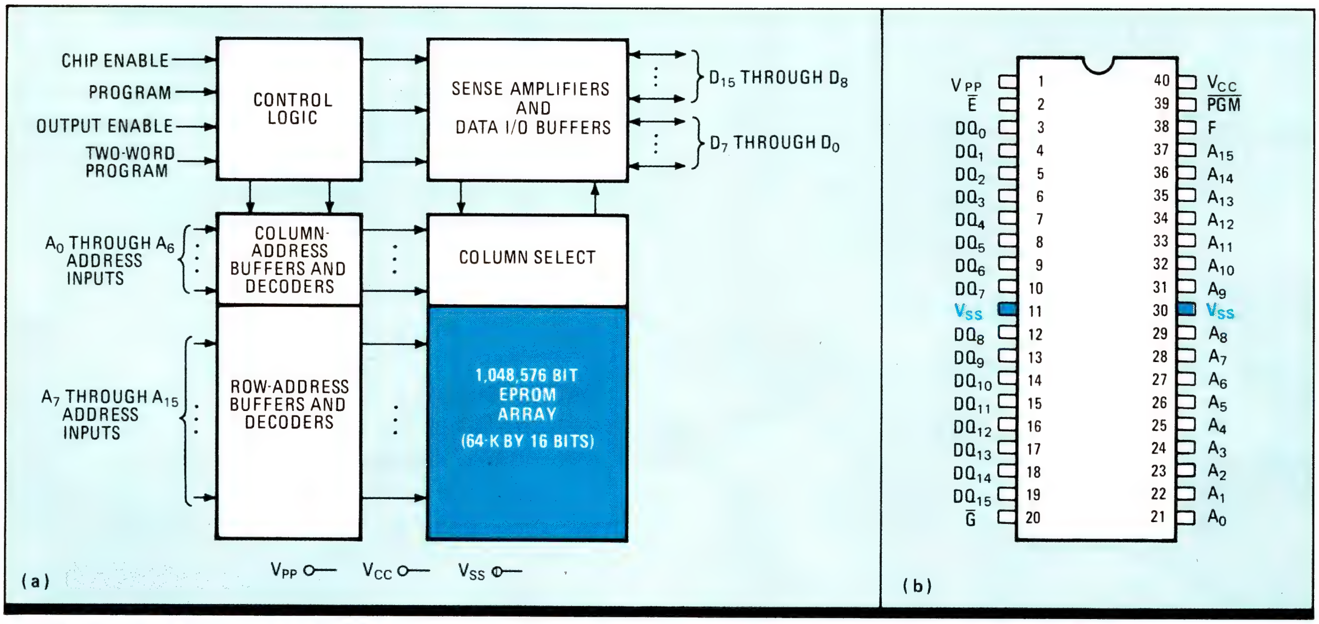
The Am27C1024 is organized as 65,536 words of 16 bits each. According to Darrell Rinerson, Bruce Threewitt, B. Venkatesh and Jih Lien, the AMD project leaders on the development team, a single chip could provide the entire program memory space—including the operating system, utility routines, and peripheral drivers—for a minimal 16-bit system. Putting this much software directly on silicon raises the system's performance, because disk access would not be required for most operations. Indeed, many simpler systems could do without a disk altogether. What's more, in systems where space for random-access memory is particularly scarce and the system performance demands that operating software be executed out of main memory as much as possible, an EPROM of this size is an alternative to down-loading program data from the disk to the RAM.

Because large amounts of program data can be stored in a few of these EPROMs, software distribution might also become easier. A cartridge containing updated or new software would be more rugged than a floppy disk, immune to magnetic disruption, and impervious to dust and similar hazards. Since the EPROM is inherently reusable, such cartridges would enjoy a long life.

The bulk storage needed in portable rugged systems would be far more reliable with no moving parts. Using these EPROMs in 44-pin leadless chip carriers mounted on two sides of a substrate to replace a 1-megabyte disk would require about 9 in.^{2} of board space, presuming that the program data did not need to be modified. This approach would bring with it drastically improved performance.

Other important applications for the 1-Mb EPROM are in digital signal processing in telecommunications, graphics for simulation systems, and speech compression and synthesis systems. With its large storage capacity, the Am27C1024 functions as a lookup table for constants used in solving linear and nonlinear equations, for fonts used in laser or text displays, or for very large encoded vocabularies for speech synthesis.

Beginning in this issue, the Technology Readout section will feature exclusive reports on significant developments in technology and major product introductions. It will provide the technical data and other information that readers need to assess the impact of these important developments.



1. 65,536 words. This 1-Mb CMOS EPROM provides 65,536 16-bit words of nonvolatile data storage, along with all the necessary addressing and control logic (a). The 40-pin DIP places the ground leads in the middle, the address input and output pins on opposite sides (b).

The Am27C1024 organization (Fig. 1a) is ideally suited to complement 16-bit microprocessors. Its nonmultiplexed electrical interface offers maximum flexibility. The chip comes in a standard 40-pin dual in-line plastic package and features a maximum access time of 170 ns over its operating-temperature and voltage range. This chip also powers down whenever it is deselected by the chip-enable input, resulting in a 100:1 power saving. Because the EPROM uses CMOS technology, it has a super-standby mode that further reduces the power requirement by a factor of six. With its low-power characteristics, the Am27C1024 can be coupled to CMOS processors and other components in designs for very powerful battery-powered microcomputers.

The designers chose the chip's organization, packaging, and pinouts to offer versatility, low cost, and ease-of-use with any type of microprocessor. The nonmultiplexed interface, although requiring a 40-pin package, enhances performance and simplifies system timing and design. Even in systems where board space is tight, the simple interface can often save extra support chips, sometimes reducing board space. This saves even more space in systems using surface-mounted packages.

Using a 40-pin DIP with a chip that has 16 outputs could pose additional problems in system designs, according to the AMD team. For example, switching all 16 outputs simultaneously often causes a large surge current in the ground lines. The Am27C1024 has two ground and two power leads to minimize the noise caused by this current surge. Further, the package-lead inductance increases significantly for pins located on either end of the DIP.

For best results, then, the ground leads are in the middle of the package (Fig. 1b). To simplify the design, the inputs and outputs are arranged in a flow-through structure—address inputs are all on one side, while the outputs are on the other. Controls are conveniently grouped at the ends.

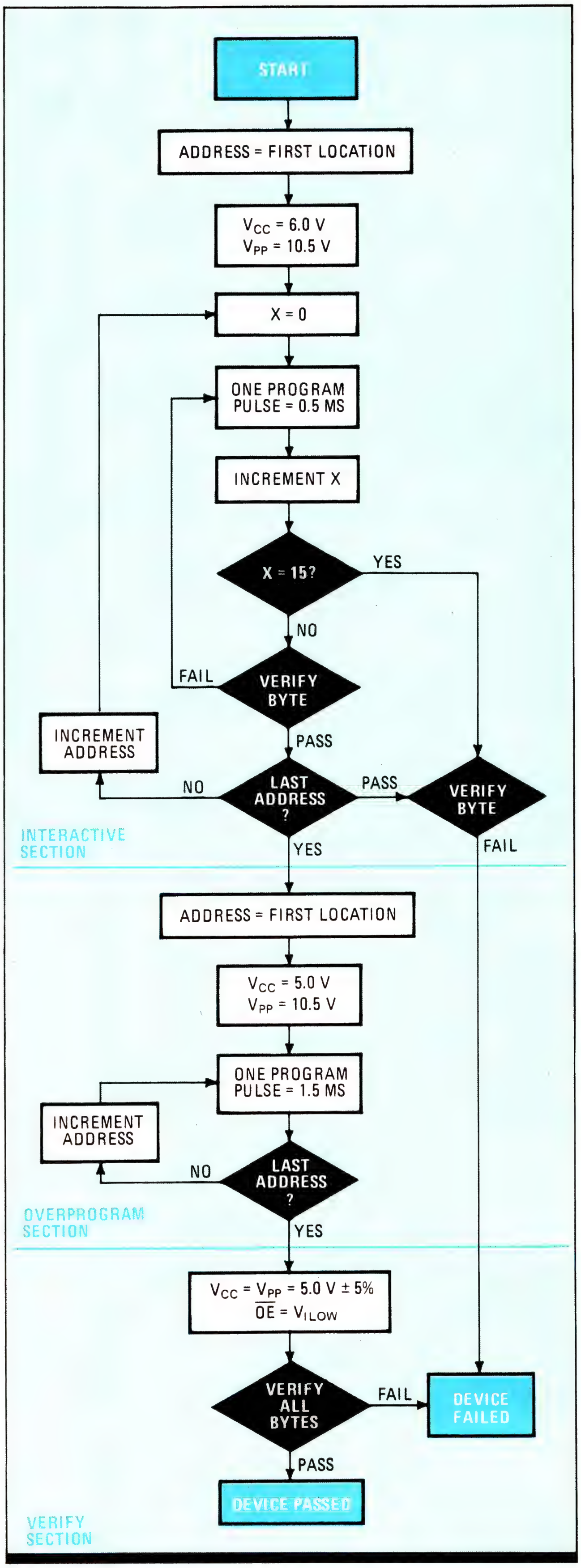
Programming considerations

Designing such a large memory to facilitate programming required some careful engineering. The chip features a mode wherein two distinct 16-bit words on the same page (same row address), whose address differs only in the least-significant address (A_0) can be programmed at the same time. Since most programming is done with sequential addressing, this feature reduces programming time.

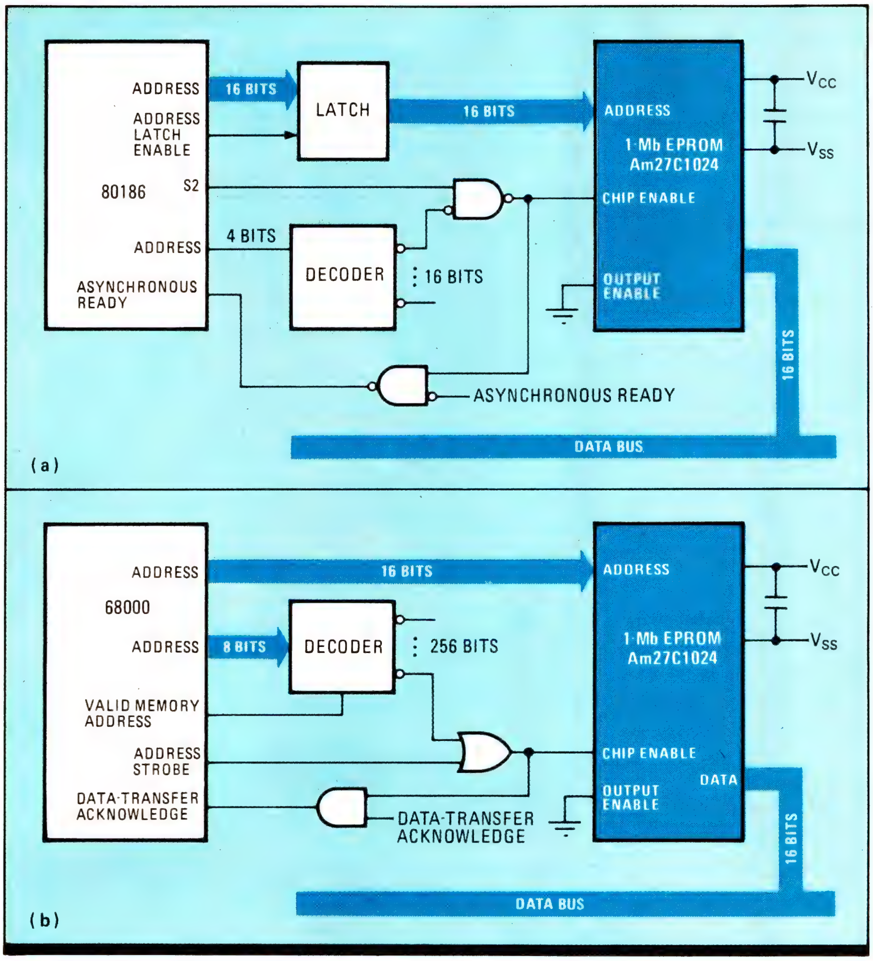
Furthermore, the technology permits a reduction in the minimum programming pulse width from the 1-ms value of previous generations to 0.5 ms. The usual over-program pulse applied after verification in the interactive programming algorithm (Fig. 2) was reduced from 2 ms to 1.5 ms. The combined result of these improvements reduces the minimum programming time for this chip from the 196 s required for the 512-K EPROM to 49 s for a memory chip with twice the capacity, Rinerson and his colleagues say. The programming voltage V_{PP} was reduced to 10.5 V for this technology.

The Am27C1024 supports the auto-select mode, which is used to identify the part type and the manufacturer in automatic programming machines. The EPROM enters this mode when the voltage on address input A_9 is raised to 10.5 V. Address input A_0 is used to select the appropriate code. When A_0 is LOW, the manufacturer's code (01Hex for AMD) appears at the outputs on the lower-order byte. When A_0 is HIGH, the part-type code (8CHex for the Am27C1024) appears at the outputs on the lower-order byte.

The choice of CMOS technology for the 1-Mb Am27C1024 EPROM is a tradeoff. Though the CMOS process requires more masking steps than an n-channel process, the use of state-of-the-art 1.5-µm CMOS circuit technology results in a smaller, yet highly manufacturable, die size of under 80,000 mil^2. The memory core is derived by



2. Programming. A three-part interactive programming algorithm was developed to significantly reduce the programming time from previous, smaller EPROMS. Besides the interactive section, the algorithm consists of an overprogram section and a verify section.



3. Electrical interfaces. The 1-Mb EPROM works with a variety of microprocessors, but electrical interfaces differ depending on the type of microprocessor the system has. For example, connections to an 80186 processor (a) are different from a 68000 interface (b).

appropriate scaling from a proven n-MOS stacked-gate transistor structure, with the first polysilicon layer forming the floating gates. Gates are programmed by hot-electron injection from the transistor channel region. Memory cell sizes are $20.25\ m^2$.

With further shrinking of device dimensions, cell sizes of approximately 12 μm^2 can be achieved; this will be enough for future EPROMs in the multimillion-bit range.

Implementing peripheral circuitry in CMOS lowers the maximum supply current and power dissipation, thus reducing chip temperatures and enhancing reliability. When the chip is active and operating at 5 MHz, it requires a 50-mA supply and dissipates 250 mW. When deselected by the chip-enable input ($\overline{CE} = V_H$), the supply current shrinks to 1 mA, with a power dissipation of 5 mW. An alternative standby mode further reduces the supply to 150 μA; dissipation depends on the chip-enable status, from 500 μW to 1 mW (when $\overline{CE} = V_{CC} \pm 0.3$ V).

Another primary benefit of CMOS technology is high-speed data access. Maximum access times of 170, 200, or 250 ns, with 200- and 250-ns performance offered over the full military temperature range, ensure compatibility with present and future generations of high-speed 16- and 32-bit microprocessors.

Numerous on-chip test modes permit thorough device testing before shipment. A silicon signature is programmed into each device to identify the part type and manufacturer for automatic programming machines. Electrostatic-discharge protection greater than 2,000 V is also provided.

Because the transistors that form the core of the CMOS EPROM resemble their proven n-MOS counterparts, by extrapolation high reliability can be expected. For example, measured charge-loss characteristics for 512-K n-MOS EPROM transistors indicate data retention in excess of 10 years. Tests on the Am27C1024 memory cells project the same retention span, says the AMD team.

The total current generated by an EPROM array while it is being programmed can be high enough to trigger nearby peripheral circuits (transient latch-up). This can be a major concern with the geometries of a 1-Mb chip. For example, an inverter can be triggered by the substrate current from an n-channel transistor that is as far away as 400 μm.

To alleviate the latch-up problem, double guard rings act as current sinks around the array. The inner guard ring (p_+) collects substrate current. The outer ring (n_+) serves as a second collector to divert electrons that would otherwise flow into the n-well. As additional protection, guard rings are also applied around selected peripheral circuits.

The high voltages required for programming are developed by an on-chip voltage pump, which raises the word lines to a higher level than that provided by the external supply (V_{pp}) and applies optimal voltages to both the control gate and drain. To avoid damaging the memory transistor, the drain voltage is regulated so that programming ocurs in the hot-electron injection (rather than the impact-ionization-breakdown region.) This technique ensures a longer device life and makes it possible to program the EPROM with a wide range of external supplies. Because the bit line voltage is at an optimum level, programming can be performed with a minimum pulse width of 0.5 ms, thereby reducing programming time. A unique two-word program mode of operation can further decrease this time by allowing two distinctly separate 16-bit words to be programmed at once.

Spares provide redundancy

Redundancy in the Am27C1024 is provided by six spare rows and four spare columns; the defective addresses are stored on electrically blown polysilicon fuses. Access time is the same for either a redundant or a nonredundant memory location, making redundancy totally transparent to the user.

AMD suggests that the most obvious application for an EPROM of this size is as program memory in microprocessor-based systems. The electrical interface varies according to the type of processor used (figures 3a and b). The nonmultiplexed, static interface simplifies timing and logic because the memory merely needs a stable address and an active chip-enable signal to provide data. The 170-ns access time allows a no-wait-state design when using the 8-MHz 80186, even considering the address latch delay.

The company plans to make the chip available in sample quantities in June. It will be in full production by the third quarter of 1985. ☐

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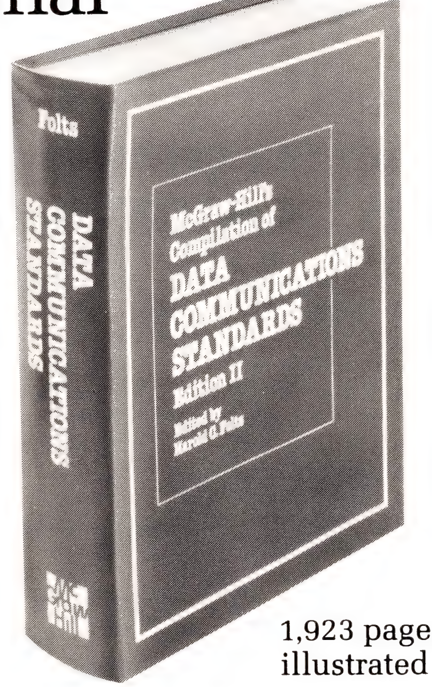
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NEW DISPLAY FORMATS GIVE USERS BETTER SHOW FOR FEWER BUCKS

by Howard Bierman and David M. Weber

NEXT WEEK'S CONFERENCE PROMISES COMMERCIAL APPLICATIONS FOR THE NEWEST TECHNOLOGIES IN ELECTRONIC GRAPHICS

Displays are getting larger, brighter, and sharper as their power demands recede, thanks to intensive research efforts in the U.S. and in Japan. Those who attend next week's Society for Information Display symposium in Orlando, Fla., can listen to 89 technical papers presented on display systems, device characterization and fabrication, and voice-entry schemes. In addition, four sessions will focus on printing technology (thermal transfer, electrophotographic, drop-on-demand ink jet, and new innovative approaches). For those who like to touch and feel, products from more than 60 manufacturers will be on view at exhibitors' booths.

Large-screen high-resolution displays are currently in demand for fans to view major sporting events and entertainment specials, for executives to discuss computer charts in conference rooms, for pilots to train on flight simulators, and for military tacticians to plan battle strategies. Soon, satellites will broadcast high-definition color TV, adding further impetus to the demand for large-screen TV receivers.

Efforts to improve cathode-ray-tube performance and lifetime, high-voltage regulation, liquid-crystal efficiency, and projection-screen viewing angle are under way at Thomson-CSF, Hitachi, Matsushita, NEC, and Asahi Glass.

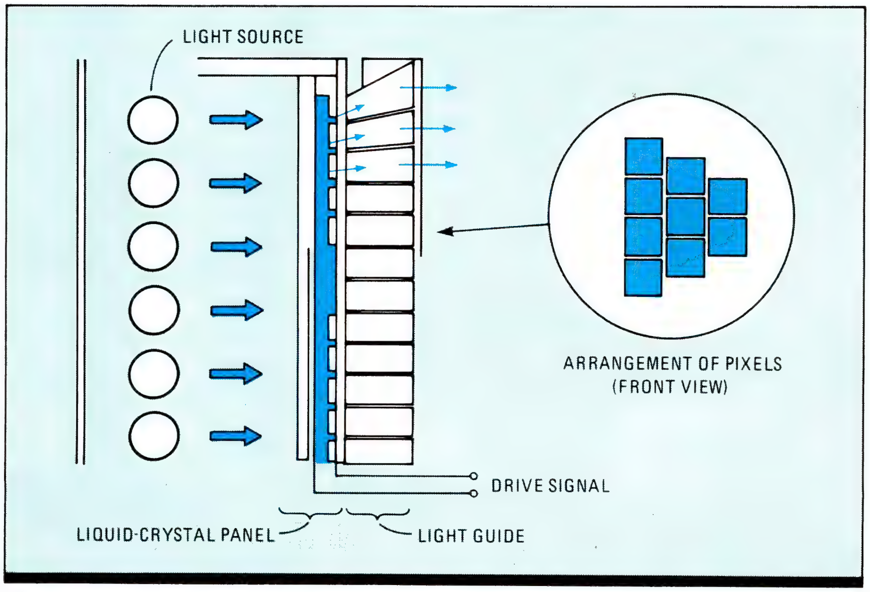
Matsushita Electronic Components Co., in Osaka, Japan, will report on a liquid-crystal-display system that fills a 3-by-12-m screen at the 1985 Tsukuba Exposition of Science and Technology. Experienced in outdoor superlarge (20-m and larger) display systems for stadiums and auditoriums, Matsushita engineers will describe their indoor large-screen system as maintaining high contrast even in bright ambient settings. The system consists basically of a display panel (a number of display units, each of which consists of an array of liquid crystals and a light source) and the control panel, which separates the video signal into the red, green, and blue color signals, converts these signals from analog to digital form, and then routes these drive signals to the display panel.

Each display unit is composed of a liquid-crystal assembly; red, green, and blue color filters; integrated-circuit modules for driving the liquid-crystal assemblies; and a light guide for orienting and dispersing the light output (Fig. 1). The display panel is structurally a collection of individual display units that are tied together to form the large-screen display. Behind the display panel is a bank of fluorescent lamps with a color temperature of 7,000 K.

Matsushita designers will tell how one drawback of earlier large-screen LCDs was the annoying visibility of the support frames that held the display units together. The new approach makes use of light guides that cover the support frames and disperse the light through the LCD units without marring the composed picture. Although the LCD's resolution is admittedly inferior to the resolution of conventional projection-TV systems, it can present a large, clear picture in bright surroundings.

Researchers at Thomson-CSF's Electron Tube Division, in Cedex, France, are focusing their efforts to improve the performance and lifetime of projection CRTs. They will report on improvements in the CRT screen—that is, the phosphor layers, the glass substrate, and the electron-gun assembly. With projection-TV systems now using a magnification factor of 40:1, blemishes that appear on the CRT screen pose a serious problem. In fact, the discernible blemish size on a 5-ft display is 50 μm.

As Thomson-CSF engineers will explain, blemishes in the form of brown spots appear when the CRT is first operated and can be minimized by tight quality control during the CRT manufacturing process. After the CRT is put into use, additional brown spots will appear because of the high (36-kV) accelerating voltage required to achieve a luminance level of 1,850 lm. Attempts to reduce blemishes by using nonbrowning glass faceplates from several glass manufacturers were un-



1. Light guides. Support frames, in the form of thin-film reflecting elements, improve brightness and are used to mechanically connect a number of liquid-crystal panels to form a large display. Support frames in earlier structures created annoying vertical bars.

successful; covering the CRT screen's phosphor grains with an inert material to avoid chemical interaction with the glass also showed no improvement. However, Thomson-CSF will report on two improved CRT screens: one is made of a fine-grain phosphor with a special settling material that keeps blemishes below 20 μm after a charge dose of 100 coulombs/cm^2, and the other uses a fine-grain phosphor, settled by centrifugation, that shows no blemishes after the same charge dose but suffers a 20% reduction in brightness.

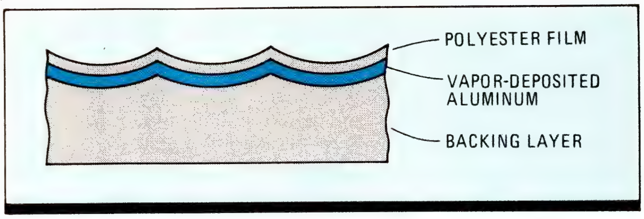
For a CRT with high luminance flux, the CRT gun must operate with beam currents up to 3 mA, which, as Thomson-CSF engineers will report, requires an impregnated tungsten-dispenser cathode rather than the conventional oxide-type cathode used in standard projection CRTs. Comparing conventional projection CRTs with Thomson-CSF's new design, a conventional CRT with a 15× magnification capability can provide a 1,850-lm flux with a 36-kV accelerating voltage and can last 700 h; the Thomson-CSF CRT with the same high voltage will provide the same 1,850-lm brightness with 40× magnification, with no objectionable blemishes, and will have an expected lifetime of 2,000 h.

Projection-screen gains

Projection screens for slide or overhead projectors, generally constructed of white matte material, offer a wide viewing angle but suffer from low gain. Therefore, they are easily affected by ambient light and are best viewed in a darkened room. Most commercial projection-TV screens are of an aluminum-foil construction, characterized by Gaussian scattering with reflected light concentrated at the center and brightness falling off rapidly for viewers who are off center.

Scientists from Asahi Glass Co., in Yokohama, Japan, will describe an improved screen surface with high brightness uniformity over a limited viewing angle. The front-projection screen is based on the unit spherical mirror concept, by which minute hexagonal elements of spherical mirrors (400-μm radius) are arranged so that they form a two-dimensional array without any flat portion. Thus if one customer specifies a screen for TV viewing and a second customer specifies one for flight simulation, different scattering characteristics can be obtained readily by simply changing the radius of the spherical mirrors during the design stage.

Asahi engineers will point out that construction of a spherical mirror array first involves a series of photolithographic processes to create an array pattern. This pattern is then transformed into a metal stamping mold by means of an electroplating process. Using this metal stamper, a mirror array is transcribed onto a plastic sheet made of aluminum-evaporated polyester film reinforced with backing layers (Fig. 2). Finally, the screen is shaped into the appropriate curvature using a urethane resin material. The polyester film protects the projection screen from soiling, and any dust or grime that collects can be easily removed.

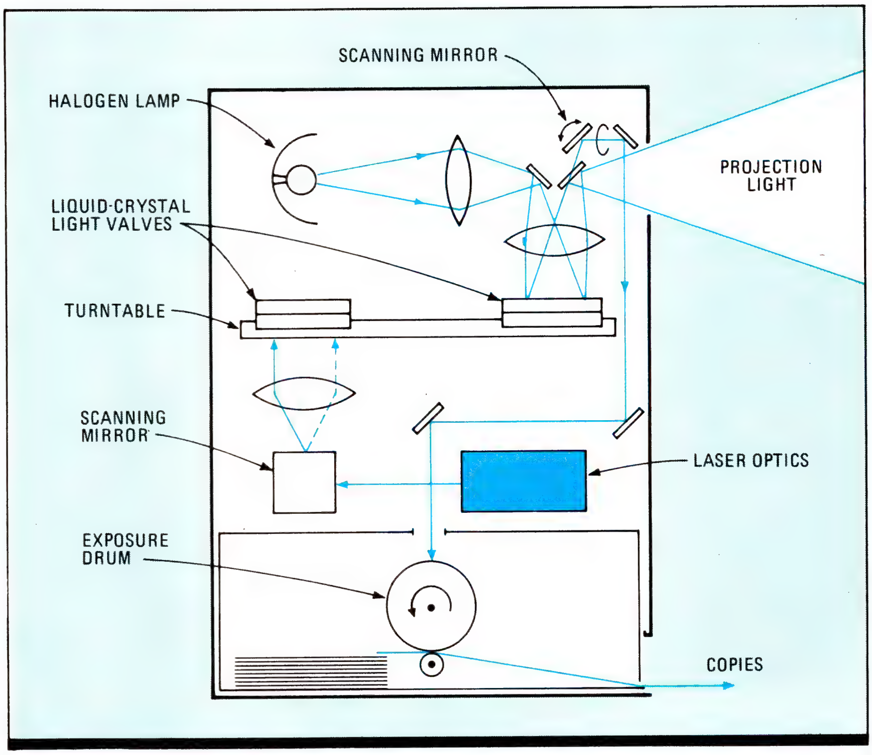


2. Efficient screen. An array of minute spherical mirrors is stamped onto a plastic sheet consisting of an aluminum-evaporated polyester film reinforced with backing layers. Asahi Glass Co. engineers claim significant brightness improvement over conventional screens.

A compact, high-resolution projector and printer with a personal computer interface will be described by researchers at NEC's Opto-Electronics Research Laboratories, in Kanagawa, Japan. The system can display 2,000 by 2,000 pixels on an 8-by-8-ft screen and can simultaneously print an A-4 size image.

The basic elements of the NEC system include laser-addressed liquid-crystal light valves mounted on a turntable, projection optics, and printing optics (Fig. 3). The laser writing optics consists of a laser that has an output of 80 mW and uses two high-power buried-coarctate mesa-structure laser diodes to produce a 10-μm beam that is directed to the liquid-crystal light valve by a two-axis scanning mirror.

The light valve uses a reflecting cell structure, with the liquid crystal sandwiched between one substrate coated with a thermal buffer layer, a vanadyl phthalocynine organic light-absorbing layer, an aluminum reflector, a silicon oxide layer, and a silicon oxide liquid crystal (Fig. 4). A 650-W halogen lamp and projection lens enlarge the 20-mm^2 image from the liquid-crystal light valve to a 2.4-m^2 screen with a 400-lm flux—about the same brightness obtained from a conventional overhead projector. By adjusting the projection lens, image size can be varied from 50 cm to 5 m. For printing hard copies, 5% of the light intensity from the projection image is directed to the exposure drum of an electrophotographic printing system. Using the personal computer interface, the 2,000-by-2,000-pixel display information can be transferred to the computer's random-access memory to permit editing of the projected image.



3. Laser optics. An 80-mW output laser, in NEC Corp.'s projector-printer combination system, produces a 10-μm spot beam that is routed to a laser-addressed liquid-crystal light valve. With projection optics, a bright 8-by-8-ft display is created.

Engineers from Hitachi Ltd.'s Consumer Products Research

Center, in Yokohama, Japan, will discuss their 54-in. rear-projection TV system, to be used with high-definition TV's 3:5 aspect ratio for wide-screen viewing. To handle high-definition TV's 1,125 horizontal scanning lines (more than double the current NTSC 525-line standard), Hitachi's newly developed rear-projection screen uses a fine-pitch lenticular lens with vertical black stripes for contrast enhancement (Fig. 5). To maintain regulation of the 30-kV high-voltage supply, Hitachi engineers devised a multilayer-winding flyback transformer to reduce leakage flux and keep variations within 200 V.

Field-sequential 3-d display

A field-sequential three-dimensional display with one CRT and no moving parts will be described by Thomas S. Buzak of Tektronix Inc., Beaverton, Ore.

Basically, the system is a series of electrically switchable mirrors stacked one in front of the other. Each mirror can be switched into one of two states: reflecting or transmitting. When an image from a CRT is reflected from the stack of mirrors, the apparent distance of the image from the observer is a function of the position of the nearest reflecting mirror (Fig. 6a).

Each electrically switchable mirror consists of at least two liquid-crystal cells. The first liquid-crystal cell is switchable between two states: zero and half-wave retardation. The second cell contains a nematic liquid crystal along with a high concentration of a chiral additive. The molecules in this cell are arranged in helices with pitches close to the wavelength of visible light. It is a property of such a cell to reflect circularly polarized light of only one sense—either right or left, depending on the handedness of the helices—and to transmit circularly polarized light of the other sense. Together, the two cells act as an electrically switchable mirror for circularly polarized light. The first liquid-crystal cell (a pi-cell) controls the handedness of the incident light that is then either reflected or transmitted by the chiral liquid-crystal cell (Fig. 6b).

Liquid-crystal cells are stacked to form a complete system with five planes (Fig. 6c). Unpolarized light from a CRT passes through a right-handed helix chiral cell and emerges left-circular polarized. Half of this light is reflected by the 45% dielectric mirror that also changes the sense of polarization from left-circular to right-circular. When pi-cell 1 is in its off-state (half-wave retardation), the right-circular light is changed to left-circular, reflected by chiral cell 1, and then changed back to right-circular on its second pass through pi-cell 1. The observer sees the image of the CRT in the closest depth plane.

When pi-cell 1 is turned on (zero retardation), the right-circular light is not altered by the pi-cell and is transmitted by chiral cell 1, traveling on toward plane 2. The reflectivity of plane 2 is controlled in a similar fashion by pi-cell 2. Planes 3 and 4 may also be made reflective or transmissive, and so any of the five planes can reflect the CRT image. If the mirrors are rapidly switched while synchronously writing information on the CRT, a composite multiplanar 3-d image is formed.

There is a strong need for detailed, high-quality graphics displays that are both portable and alterable by the user. Preoccupation with graphics is particularly strong in Japan, where textual displays with Kanji characters are the functional equivalent of pictures. Therefore, most of the research into new display technology comes from Japanese firms that already have a firm footing in electronic imaging—especially wristwatch and TV manufacturers.

Indeed, the established technology for electronic text and graphics up to now has been the CRT, which, although optically excellent and relatively cheap to produce, is bulky, heavy, and power-hungry. Although CRTs have recently become smaller and lighter (mostly because of improvements in deflection circuitry), a search has been under way for a more portable replacement. So far, the most promising avenues for development have been LCDs and plasma-gas displays, and manufacturers of these and other new formats are preparing to compete head on with the established technology of the cathode-ray tube.

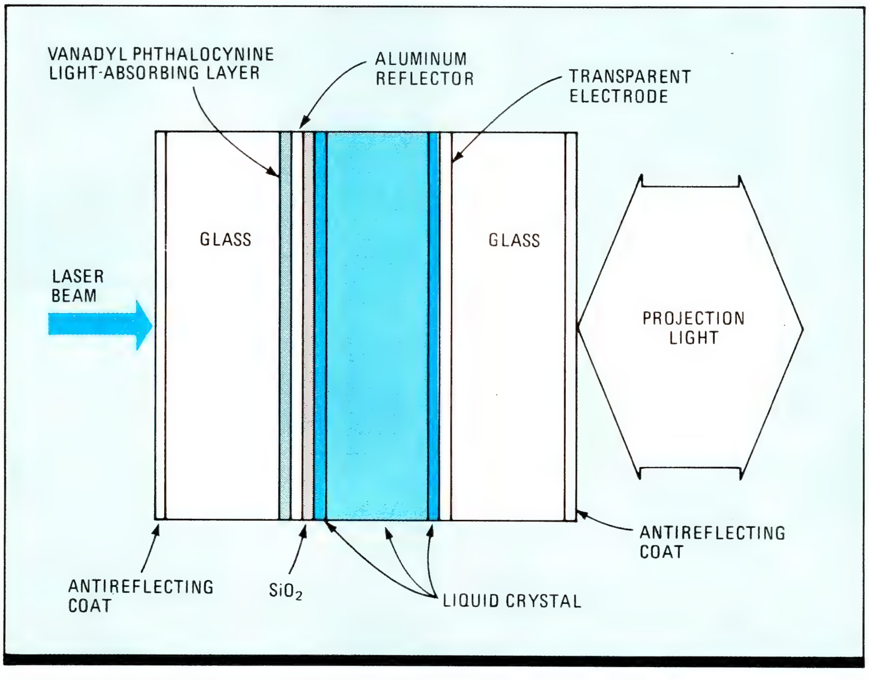
Problems with power

For a large-capacity plasma display that requires many scan electrodes, the power supply's driving frequency must be high enough to maintain a constant luminance. Unfortunately, this also raises power consumption, thereby negating one of the potential advantages of plasma displays over CRTs.

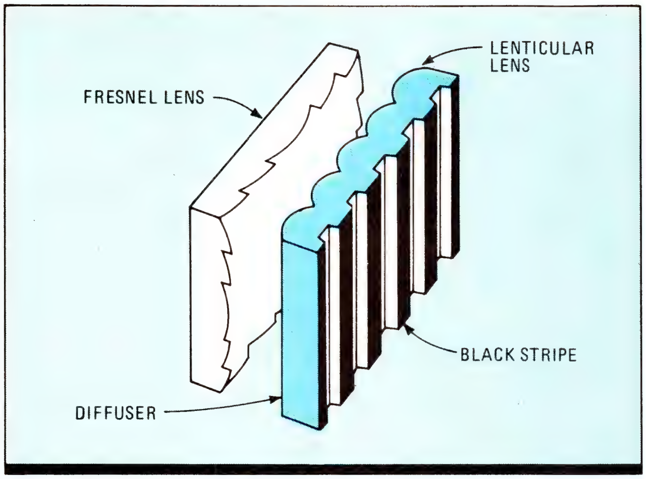
Engineers at NEC Corp., Kawasaki, Japan, will report on their efforts to solve this problem by using a new driving circuit based on a phase-selection technique. The company will announce a high-resolution full-graphic display with a capacity at least as good as that of a CRT. This prototype display can have one of three pixel configurations: 640 by 400, 720 by 350, or 512 by 256.

Plasma displays can accept direct current, which facilitates the restoration of a previous image when the current is switched off and on. But dc displays cannot be used for broadcast video, the greatest potential application for any display technology. Therefore, most designers of flat-panel competitors to CRTs use alternating current as a power source. The NEC prototype has an interface that closely resembles that of a CRT, easing the transition from one technology to the other.

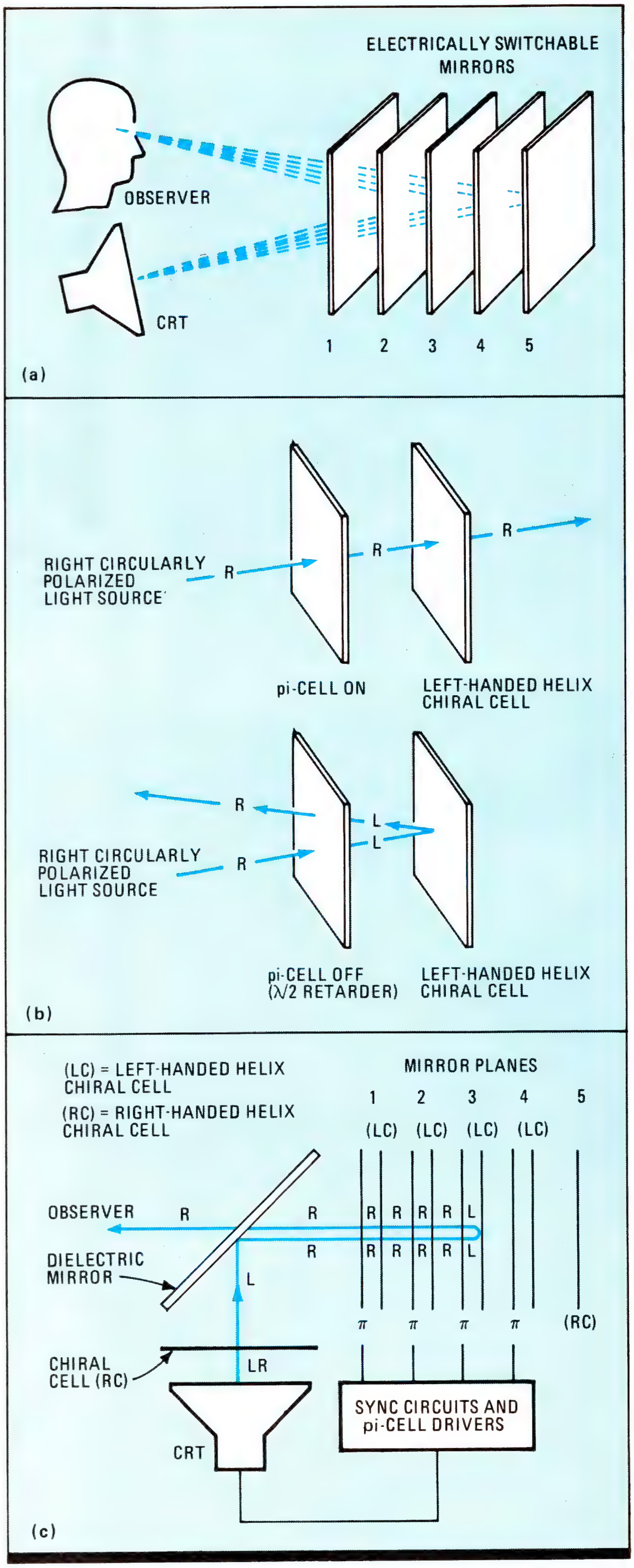
In the NEC design, silver electrodes are formed on the rear glass by thick-film techniques, which are then covered by a black dielectric layer. The spacers on the dielectric layer are formed so



4. Liquid-crystal sandwich. The liquid-crystal light valve reflecting-cell structure, developed at NEC Corp., consists of a liquid crystal sandwiched between a thermal layer, a vanadyl phthalocynine organic layer, an aluminum reflector, and a silicon oxide layer.



5. Fine-pitch screen. To accommodate the 1,000-horizontal-line resolution of high-definition TV, the pitch of Hitachi Ltd.'s rear projection screen's lenticular lens is only 0.62 mm. Black vertical stripes are included to improve picture contrast.


ELECTRICALLY SWITCHABLE MIRRORS
OBSERVER
CRT
1
2
3
4
5
(a)
RIGHT CIRCULARLY POLARIZED LIGHT SOURCE
R
R
R
pi-CELL ON
LEFT-HANDED HELIX CHIRAL CELL
RIGHT CIRCULARLY POLARIZED LIGHT SOURCE
R
R
L
L
pi-CELL OFF (λ/2 RETARDER)
LEFT-HANDED HELIX CHIRAL CELL
(b)
(LC) = LEFT-HANDED HELIX CHIRAL CELL
(RC) = RIGHT-HANDED HELIX CHIRAL CELL
MIRROR PLANES
1 2 3 4 5
(LC) (LC) (LC) (LC)
OBSERVER
R
R
R R R R L
DIELECTRIC MIRROR
R
R R R R L
L
π π π π
(RC)
CHIRAL CELL (RC)
LR
CRT
SYNC CIRCUITS AND pi-CELL DRIVERS
(c)

6. 3-d images. Tektronix Inc.'s field-sequential three-dimensional display system (right) makes use of electrically switchable mirrors (a). The state of the pi-cell controls light transmission or reflection (b). Stacked cells are arranged to form a working system (c).

that they are orthogonal to the silver electrodes. This technique not only determines the gap of the discharge cell but also acts as a barrier to prevent crosstalk. The front glass includes the transparent electrodes, which are covered with a transparent dielectric layer. To improve surface contrast, the black masking layers (with a thickness of less than 10 μm) are formed between parallel transparent electrodes. Both the masking layers and the spacers are formed with standard printing and baking techniques.

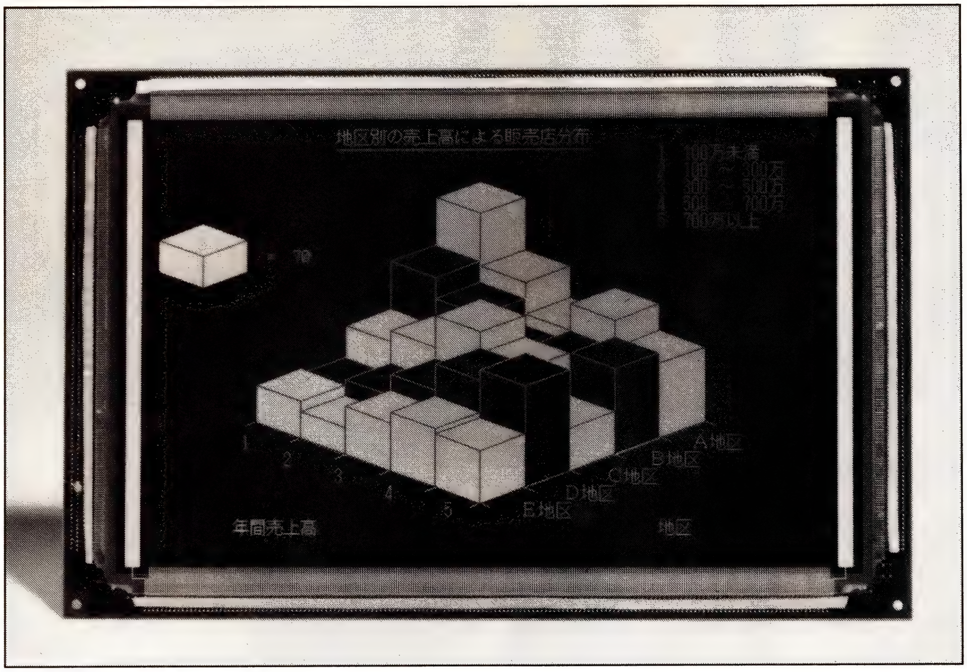
Over the past two years, the intensity of the firing voltage needed to achieve a given display-panel luminance has dropped substantially—from about 230 to 160 V ac. Improved techniques for reducing the thickness of the panel's metal-oxide layer to about half its former value is chiefly responsible for the improvement. However, the decisive factor in determining the quality of a plasma display is the contrast ratio of the light-emitting cell to the non-light-emitting background material. To optimize contrast, NEC covered the inside of the front glass—except the pixels—with a black layer. Because the front electrode is transparent and a black dielectric layer is coated over the rear-glass side, the entire display is black when unlit. When the pixels are lit, a neon-orange display appears in sharp relief. Furthermore, nonglare front glass eliminates reflection from the panel surface, obviating the use of a filter (Fig. 7).

Because the major appeal of a plasma display is its thinness, designers have also focused on reducing the depth of the panel. Until 1984, a panel was considered to be thin if the combined depth of the front and back plates was about 4 mm. Industry observers predict, however, a state-of-the-art depth of 2 mm by 1986. Such an improvement can be achieved by better techniques for manufacturing the spacers that define the pixels on the display panel, which would permit thinner masking layers.

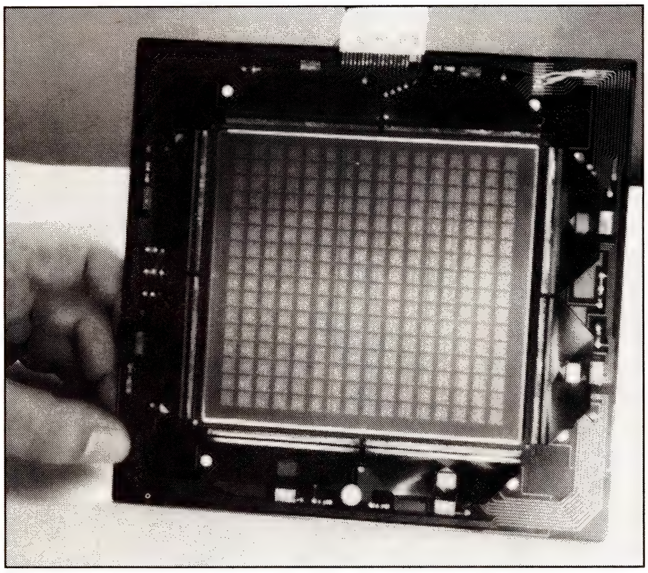
Another improvement is more precise control of the ac firing voltage that refreshes the plasma display. In the present generation of displays, one phase is applied to the row electrode and the other to the column electrode. In what NEC designers term the "phase-selection-drive method," the rows and columns that are actually displayed at a given time are in effect fired by a single ac phase. The reverse phase fires the row electrode only when the column electrode is in the nondisplay mode, and vice versa. In this way, power requirements are halved, and lower-power ICs can be used in the design.

For the NEC prototype, the row driver is a flatpack IC with 32 circuits of shift registers and MOS drivers. It puts out a 180-V peak-to-peak high-frequency pulse for scanning the row electrode of the panel. The column driver also uses flatpack ICs, with 64 CMOS shift registers, latches, and MOS drivers to put out a 30-V peak-to-peak high-frequency pulse.

A final point to be stressed by the NEC designers is the



7. Refreshed display. NEC Corp.'s ac refresh 640-column-by-400-row plasma display prototype produces a neon-orange image. For best contrast, the inside of the front glass, except for the pixels, is coated with a black layer. Nonglare front glass eliminates the need for a front-panel filter.



8. Full-color LCD. Although its contrast level is too low, Suwa Seikosha Co.'s 5-in.-diagonal guest-host phase-change LCD produces an adequately bright full-color picture. Standard azo dyes serve as the host material to obtain optimum contrast, still low when compared with twisted-nematic-based LCDs.

compatibility of the interface signal at the column electrode with the data, clock, and sync signals of a computer's CRT interface. This will be important when plasma displays become a more compact alternative to the CRT displays of microcomputers.

Another display format that has already come into its own for both computer graphics and TV broadcasts is thin-film liquid crystals. A pervasive problem with LCDs, however, is the need for backlighting to display high-intensity pure color. Current-generation backlighting needs an additional light source and increases the system's power requirements. Engineers at Suwa Seikosha Co., Nagano-ken, Japan, will discuss how they are trying to avoid this problem by eliminating the polarizer associated with backlighting systems.

Backlighting solution

Usually, the liquid crystal that acts as the light valve employs the twisted-nematic mode, which has become standard for LCDs. To rectify the light output at the display, however, a polarizer must be incorporated into the design, which results in a light loss approaching 60%. Moreover, the conventional color filter can transmit only about 20% of the incident light. Therefore, a liquid-crystal light valve without a polarizer and a new color filter with good transmissivity are required to reduce the power consumption of the backlight.

The Suwa Seikosha approach involves the development of a phase-change LCD that eliminates the polarizer. The twisted-nematic mode is replaced by a guest-host approach that does not distort the liquid-crystal light output and permits visibility over a wide range of viewing angles. Polysilicon thin-film transistors are applied to the pixel electrodes, which are located on the lower glass. The color filter with the red, green, and blue elements is located on the upper glass, with the liquid crystals held in between.

Suwa Seikosha has reported good color quality with its guest-host technique. The technique achieves optimum contrast with standard azo dyes serving as the host material.

Still, contrast was reported to be a problem compared with the twisted-nematic LCDs that are now on the market, even though brightness and color fidelity were improved (Fig. 8). The hysteresis curve of the phase-change mode falls off too sharply when the applied voltage is increased, and this causes a degradation in gray scale. Accordingly, it has been suggested that this technology is most suitable for the display of text or of detailed graphics that don't require a lot of shading, such as written Japanese or Chinese.

Although twisted-nematic LCDs have their advantages (not the least of which is commercial availability), one of their serious limitations is an inability to readily accept direct information input to the display face. Anything that disrupts their helical configuration may render the liquid crystals unresponsive to an information-carrying signal.

To overcome this limitation, engineers at Hitachi Research Labs, in Ibaraki-ken, Japan, have developed a thermally addressed smectic LCD with a memory function. Information is added at the display face with a semiconductor laser light pen having a power output of 20 mW. To effectively convert laser power into heat, 1.7% of the liquid crystals contain infrared-absorbing dye.

Text and graphic inputs to the screen (with a resolution of 4 lines per millimeter) are read out electrically by detecting pixel capacitances. Crosstalk is avoided by keeping the heating parameter of the light pen within the smectic phase of the liquid crystals in the display—the crystals are not heated into nematic or isotropic phases. This approach largely eliminates thermal-management problems, according to engineers in Hitachi's research group, and will permit the eventual development of large-display LCD panels. ☐

SPEECH TECHNOLOGY LEAVES THE REALM OF SCIENCE FICTION

by Tobias Naegele

Voice-recognition and speech-synthesis systems are finding real-world applications in such areas as automobiles and computers

In *Player Piano*, a futuristic novel published in 1952, author Kurt Vonnegut Jr. describes an automobile that welcomes the driver when he turns on the ignition and advises him not to take any wooden nickels when he shuts it off. In the 1950s, talking machinery may have seemed a farfetched notion; but today, synthetic speech is finally getting some recognition.

Detroit's Big Three—General Motors, Ford, and Chrysler—now offer talking automobiles that remind drivers to "Fasten your seatbelt," and warn that "Your oil pressure is low." Moreover, according to a reliable industry source, the flip side of computer speech, voice recognition—where spoken commands will activate specific preprogrammed functions—will make its way into commercially available automobiles very soon.

Thus far, automobiles have utilized only the most primitive forms of speech technology—indicating that there is more to these talking cars than sophisticated but quasi-useful gadgetry. Apparently, speech technology is emerging from its stone age.

Computerized voice recognition and speech synthesis are finding applications in industrial production, military equipment control, office automation, and aid for the handicapped. Software developers are beginning to build speech options into their programs, and the British computer maker Applied Computer Techniques Ltd. has begun marketing a portable computer with built-in speech-recognition features.

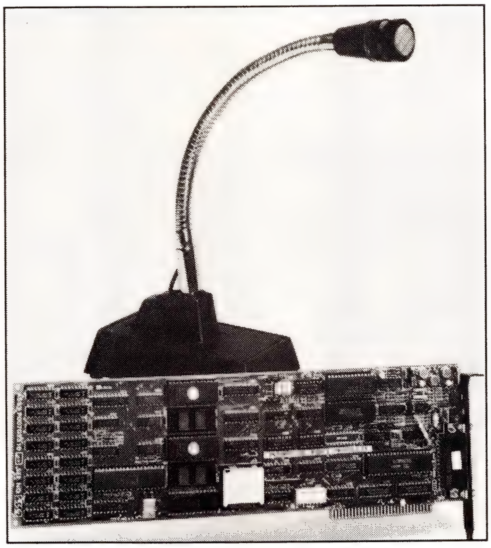
"Once speech I/O is broadly available, people will not want to be without it," says Janet Baker, president of Dragon Systems Inc., a leader in speech-technology development and the developer of the speech-recognition algorithm used in Applied Computer Techniques' Apricot Portable computer. "We really are on the threshold of something very new."

All this is not to say that speech synthesis and voice recognition have fully blossomed and are now taking the world by storm. A 1984 report by the Committee on Computerized Speech Recognition Technologies (sponsored by the National Research Council) concluded in part that though there is "distinct potential" for the technology in military and other government applications, "current technology is [only] mature enough to support restricted applications in benign environments" and "is not sufficiently advanced to provide robust, reliable performance in hostile and high-stress environments."

But a lot has changed in the past year, says Stanley Goldstein, president of Media Dimensions Inc., the publisher of *Speech Technology* magazine and sponsor of Speech Tech '85, the voice input/output applications show and conference opening today in New York. "There's been a greater influx of new and up-and-coming companies," he says. "Companies are crawling out of the woodwork with new software, new products, new devices."

Speech Technology's annual directory grew from 130 listings in 1984 to about 180 listings this year. But this is not the peak, Goldstein says, who predicts already that "1986 is going to be a much bigger year than 1985."

Much of the major work right now is in software: the ability to shrink enormous recognition systems into smaller, inexpensive software packages. "The fact that they [advanced speech recognition



Plugging the PC market. Interstate Voice Products' CSRB240, is a plug-in board for IBM Corp. Personal Computers and compatibles.

Standing alone. The Verbex System 4000 voice recognizer allows voice input to augment other data entry methods on almost any mainframe or micro-, mini-, or personal computer.

packages] can be gotten into software is a huge advance," Baker says. "In the very [recent] past, high performance has always been generated by using a lot of hardware—a ton of memory."

Dragonkey, an integratable software facility for speech control of off-the-shelf, readily available software programs, provides desktop computers with extensive voice-recognition capabilities that were available previously only on full voice I/O systems in the $15,000 price range. Dragon Systems licenses the software, which runs under MS-DOS and supports full on-line speech-recognition console facilities, for $10 per license in 10,000-unit quantities. The system, which is 99.3% accurate, includes pop-up help menus, user-defined speech-executive function keys, talk-ahead capabilities, and fully mixed speech.

"Most people use less than six programmable function keys" on their computer keyboards, says Baker, who also chairs the Institute of Electrical and Electronics Engineers Working Group on Speech I/O Performance Evaluation. "Speech gives you a very large set of programmable functions" that are more easily remembered by the user than a specific key or a set of numbers. "It's a way of making today's software a lot more accessible. The dyed-in-the-wool hacker will get through anything, but the average user cannot—or will not—bother" to learn the ins and outs of a given program, and thus never realizes its full potential.

Dragon Systems, a three-year-old startup, also licenses Dragonlab, an MS-DOS development facility that is designed to help the systems engineer test the performance quality of a system integrating Dragonkey, and to perform comparisons of different command vocabularies. It is provided free of charge to the company's customers. Dragon's $3,000 evaluation board plugs into an IBM Corp. Personal Computer. With it, customers can evaluate and develop different speech-recognition applications using the company's speech algorithm and then tailor those applications to their needs. Vocabularies are limited only by the memories in the PCs. The evaluation board includes the recognition software, microphones, applications interface software, and Dragonlab.

Linear conversion. Adisa Corp.'s VX2, a plug-in board for IBM Personal Computers and compatibles, converts human voices into linear predictive codes for voice synthesizers.

Verbex offers a ready-to-use continuous-speech voice data-entry system that allows voice input to replace or augment other data-entry systems. The System 4000 Voice Recognizer, priced at $4,900, operates in conjunction with virtually any mainframe or mini-, micro-, or personal computer as well as with industrial controllers.

A stand-alone recognition system. Consisting of a compact console and a microphone headset, the 4000 boasts a small 100-word vocabulary. But it can recognize words spoken in a steady stream (simpler systems require discrete pronunciation, with pauses between each word) and features a recognition response time of just 300 ms.

Using its patented speaker-dependent continuous-speech algorithm, the 4000 features front-loading, reusable, pocket-sized voice cartridges with CMOS memory to store user voice patterns and vocabulary. These cartridges are programmed on an ASCII terminal using Verbex's Voice Planner software, a menu-driven program that provides prompts, which users must repeat into the headset microphone. The program carries a price tag of $500.

The VET-232 SD voice-entry terminal, a continous-speech-recognition system with a 200-word vocabulary developed by Scott Instruments Corp., is also speaker-dependent, but it carries a comparatively small $4,000 price tag. An optional feature allows speaker-independent recognition for a limited vocabulary, such as "yes," "no," and the digits 0 through 9. Despite the option's limited vocabulary, it can still be very useful in sales applications because it enables a full staff of salespeople to call in orders simply by using the designated vocabulary to answer computer-synthesized questions.

As with Dragonkey, Scott's Keyvet feature allows users to incorporate voice capabilities into existing software packages without any direct modification to the application software itself. A stand-alone subsystem, the VET-232, has 128-K bytes of RAM (expandable to 256-K bytes), a standard RS-232-C interface for communicating with the host computer, and its own power supply, microphone, and speaker. According to the manufacturer, it is the only commercially available system that operates effectively over standard telephone lines and in high-noise environments.

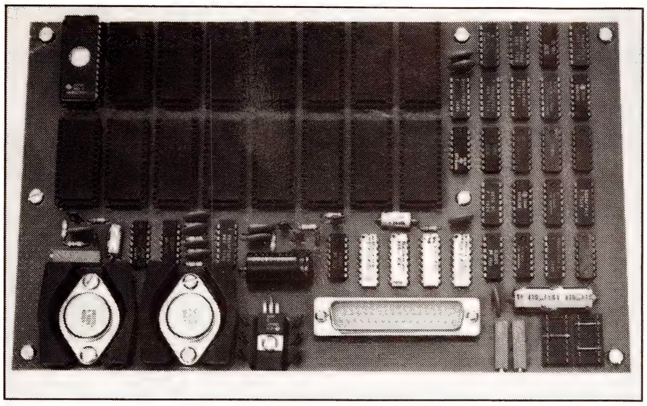
Plug-in boards for IBM PCs. One of several new plug-in boards for IBM PCs and compatibles that provides speech capabilities is the CSRB240 from Interstate Voice Products. The board, which will not be shipped in quantity until May, has a 240-word discrete vocabulary. With its connected-word feature, however, users can structure a vocabulary of 15 to 20 words, such as numbers, which can be spoken in connected fashion. The board uses an 80186 microprocessor from Intel Corp. and has 128-K bytes of RAM; it is unit-priced at $1,650.

Texas Instruments Inc.'s latest entry in the voice I/O market is a plug-in board for IBM PCs and for its own Professional Computer family. TI-Speech can be programmed to recognize either discretely spoken or connected words, depending on the preference of the user.

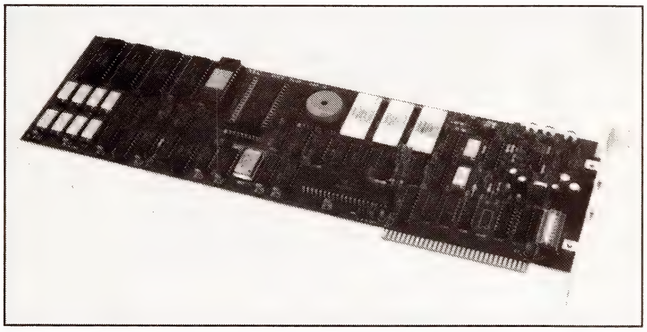
Vocabulary Manager and Transparent Keyboard, the system's basic software programs, are virtually self-explanatory. The vocabulary feature guides users as they define a vocabulary of up to 50 words, training the system to understand the spoken commands. Transparent Keyboard performs functions when activated by voice in much the same way as if the user had entered the commands on a conventional keyboard.

Software for phone management, speech-application development, and text-to-speech synthesis are all available for the TI board. The text-to-speech option converts ASCII text to voice output with pronunciation precision for an unlimited English-language vocabulary. User-adjustable speaking rates of 50 to 300 words/min are permitted on the optional program. Pricing for the speech board, a microphone, an external speaker, and diagnostics software is $995. A fully configured system with all the required software is $1,500.

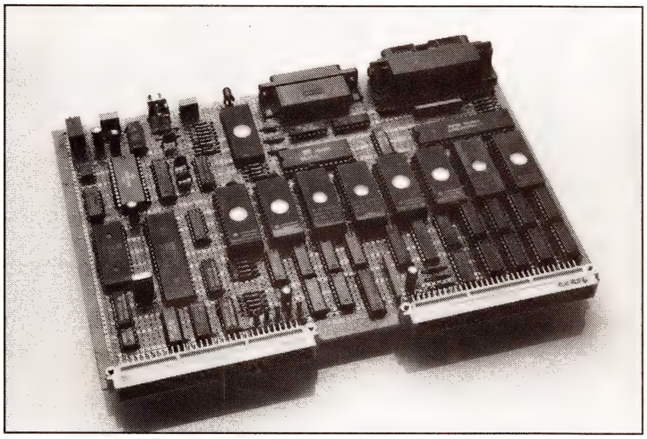
NEC America Inc.'s SAR-10 Voice-Plus, a fully integrated voice-recognition and audio-response plug-in board for IBM



Tough customer. Originally developed for rugged mining applications, Mimic Inc.'s VOIS can be equipped with a parallel interface, allowing an external computer to trigger spoken responses.



Complete voice I/O. Another plug-in board for IBM Corp. Personal Computers, NEC America Inc.'s SAR-10 Voice Plus has 250-word vocabularies for both voice recognition and synthesized response.



Bus customer. Microvoice Systems Corp.'s MC1500, an adaptive differential pcm voice-response card, works with either Multibus or VMEbus systems and in stand-alone applications.

PCs, has a recognition vocabulary of up to 250 words with better than 98% accuracy. Priced at $1,495, the system has an on-board adaptive differential pulse code modulation chip for voice synthesis. With a limited response vocabulary of up to 250 words, Voice-Plus features user-selectable digitizing rates of 24-, 28-, or 32-K bytes/s.

For IBM PC users interested solely in speech synthesis and not in recognition, there is a pair of plug-in boards from Adisa Corp. and Street Electronics Corp. Adisa's VX2 converts human voices into linear predictive codes for voice synthesizers. The board and software system are considered an affordable ($980) alternative to custom linear-predictive-code voice encoding, which can cost up to $100 to $200 for a single word. Hardware features a μ-law codec for digitizing and playing voice at 8-K bytes/s and an SP-1000 synthesizer for editing synthesized voice at 300 to 400 bytes/s; interactive software permits digitization of human voices, conversion into linear-predictive-code algorithms, and a parameter editor that optimizes voice quality.

The PC^2 offers two modes: a 700-word limited vocabulary in a natural-sounding female voice and an unlimited vocabulary in a robotic voice. The board and software set sells for only $149.95; it fits in the IBM PC/XT's short slot and works with most IBM compatibles. Simple commands are used to control the rate of speech, pitch, and volume. The phoneme-based text-to-speech program can read displayed text back in either word-by-word or letter-by-letter formats, or with all, most, or some of the punctuation spoken.

Mimic Inc.'s VOIS (Vocal Output for Industrial Systems), another board-level product, was initially developed for rugged mining applications and is now being marketed commercially for $399. In a stand-alone configuration, phrases are triggered by switches. VOIS circuitry scans 16 inputs, and a switch closure causes the corresponding phrase to be spoken—delivered by an on-board 15-W amplifier to an external speaker. With a parallel interface, phrases can be triggered from an external computer. With a microcomputer, a development system can be built for about $169 using Mimic's Speech processor, microphone, and speaker.

Can stand alone. VMEbus and Multibus applications are served by Microvoice Systems Corp.'s MV1500, an adaptive-differential-pcm voice-response card that can also be used in a stand-alone configuration. Priced in 100-unit quantities at $500, the unit stores up to five minutes of audio information in EPROM and features interfaces for RS-232-C serial, Centronics-compatible parallel, and programmable setups.

Vocabulary is limited only by the size of the memory in the host system. Up to 512-K bytes of EPROM can be held on board (representing about 512 words), but RAM buffering permits data to be downloaded from a variety of sources. "If you've got a Winchester, you've got the world—any language you could want," says Bruce Bailey, vice president of marketing at Microvoice. Both products feature variable bandwidths from 2 to 8 kHz.

The company's MV1000 encodes and decodes true audio speech using adaptive differential pcm techniques. A stand-alone unit costing $2,990, the MV1000 typically stores an individual word in about 1-K byte of RAM or EPROM and can be operated with the MV1500. Its internal memory can store up to 40 minutes of audio—speech, music, or any other desired audio output.

Adisa Corp., P.O. Box 1364, Palo Alto, Calif. 94302. Phone (415) 326-7303 [Circle reader service number 390]
Dragon Systems Inc., Chapel Bridge Park, 55 Chapel St., Newton, Mass. 02158 Phone (617) 965-5200 [Circle 391]
Interstate Voice Products, 1849 W. Sequoia Ave., Orange, Calif. 92668. Phone (714) 937-9010 [Circle 392]
Microvoice Systems Corp., 23362 Peralta Dr., Suite 5, Laguna Hills, Calif. 92653. Phone (714) 859-1091 [Circle 393]
Mimic Inc., P.O. Box 921, Acton, Mass. 01720. Phone (617) 263-2101 [Circle 394]
NEC America Inc., 8 Old Sod Farm Rd., Melville, N.Y. 11747. Phone (516) 753-7000 [Circle 395]
Scott Instruments Corp., 1111 Willow Springs Dr., Denton, Texas 76205. Phone (817) 387-9514 [Circle 396]
Street Electronics Corp., 1140 Mark Ave., Carpinteria, Calif. 93013. Phone (805) 684-4593 [Circle 397]
Texas Instruments Inc., Data Systems Group, P.O. Box 809063, Dallas, Texas 75380. Phone (800) 527-3500 [Circle 398]
Verbex, 2 Oak Park, Bedford, Mass. 01730. Phone (617) 275-5160 [Circle 399]

SCOPE COMBINES SPEED WITH DEEP 32-K MEMORY

An exciting array of other new products will bow at this week's Electro/85 show

Combining the advantages of a transient waveform recorder and oscilloscope in one small package, the 9400 digital-storage oscilloscope boasts a 125-MHz analog bandwidth with 32-K-word acquisition memories on each of its two channels. The portable 30-lb instrument includes the control, display, and analysis functions required by demanding tasks such as automated test and computer-aided measurement.

In addition, the 9400 features complete programmability (over an IEEE-488 interface) and extensive interfacing options for remote control, hard-copy output, and computer archiving. The 9400, which marks LeCroy's first entry into the scope market, capitalizes on the firm's experience with other types of instrumentation. It will be manufactured by the firm's European operation, in Switzerland, which also designed it.

LeCroy is shooting for 25% of the market, according to Ray Chevalley, the company's managing director and leader of the design team. For LeCroy to make such deep inroads, it will have to cut into the sales of some tough competitors. For example, Tektronix Inc. owns about 30% of the market, closely followed by Phillips Test and Measuring Instruments Inc. and Gould Inc., each with a 20% to 25% share, says Edward White, a vice president and senior investment analyst for E.F. Hutton and Co. The market for digital scopes was $150 million in 1984 compared with $800 million for analog scopes, Chevalley says. But the digital segment is growing at 25% to 30% per year, whereas the analog-scope market is growing at 10% a year or less.

Both input channels feature 100-megasample/s, 8-bit analog-to-digital converters. The high resolution of the converters in concert with the large memory guarantee absolute amplitude and phase correlation, maximum performance of analog-to-digital conversion for both single- and dual-channel acquisition modes, as well as unprecedented time resolution and record length.

The 9400 has an interleaved sampling rate of 5 gigasamples/s. A precise time-measurement technique makes it possible for the instrument to measure repetitive signals at full bandwidth with measured points every 200 ps. The 32-K-word memory lengths ease transient capture; in addition, they permit zooming in on recorded phenomena with expansion factors up to 100× time-base speed under digital control.

The scope's 5-by-7-in. display has a 1,024-by-1,024-pixel resolution for accurately reproducing multiple waveforms and parameter settings. The scope uses rotary knobs rather than a keypad, so that it feels like an analog scope to its users.

The digitially controlled trigger offers such facilities as pre- and post-triggering, bi-slope and window, and sequence and roll modes, in addition to standard operating modes. A flexible, precise cursor system measures voltage, time, and frequency on input and processed waveforms. Built-in automatic calibration gives excellent overall accuracies to ±0.2% for vertical gain, ±1% of V/division setting for vertical offset, and ±20 ps root-mean-square for the crystal-controlled digital time base.

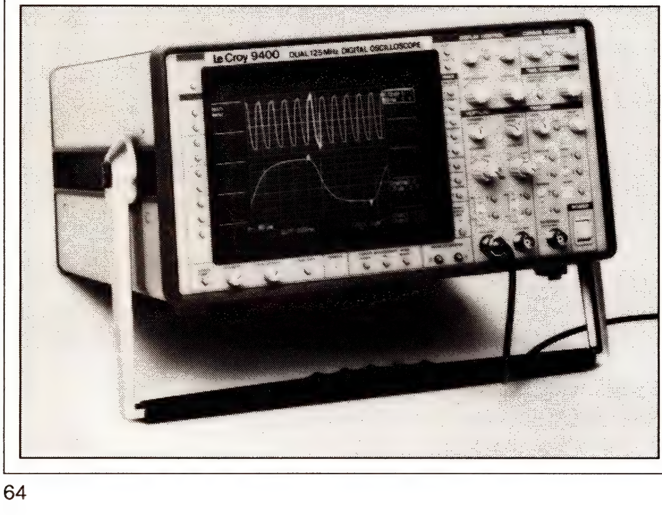
Menu-driven waveform-processing routines complement the 9400's hardware measurement functions. Signal averaging improves signal-to-noise ratios; arithmetic waveform processing provides addition, subtraction, and multiplication of complete signal arrays. The memory can store up to eight control settings. The 9400 sells for $14,900, with delivery scheduled to begin at the end of May.

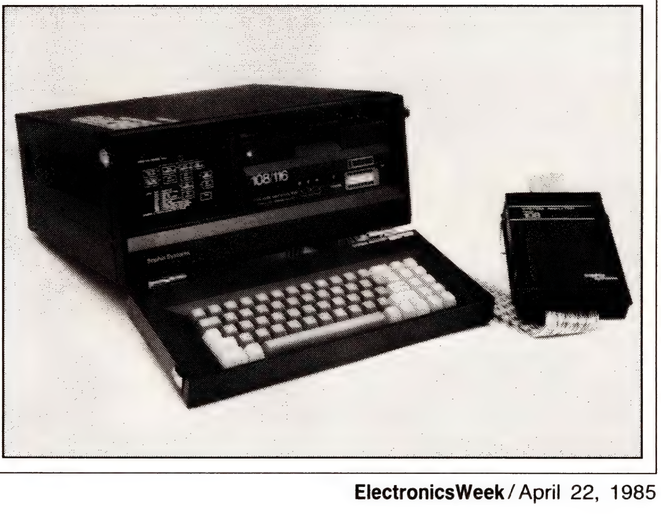
LeCroy Research Systems Corp., 700 S. Main St., Spring Valley, N.Y. 10977. Phone (914) 425-2000 [Circle 338]

In-circuit emulator serves entire V20 and V30 family

A portable instrument provides in-circuit emulation for NEC's entire CMOS V20 and V30 families of microprocessors. The SA700-108/116 stand-alone emulator, which will also support the upcoming V40 and V50 processors, is object-code and symbol-file compatible with NEC's relocatable assembler, linker, and C and Pascal compilers.

The SA700 emulator is a portable system that combines a real-time 8-MHz in-circuit emulator, CRT display, fold-down keyboard, 8-in. floppy-disk drive, built-in PROM burner, and a one-line assembler/disassembler. Physically, the system is the size of a portable personal computer—7 by 16 by 19 in. In addition to the RS-232-C serial port, the unit features a Centronics-compatible printer port, a video output port, and an external signal port with five inputs and three outputs to





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simulate I/O activity and to trigger external equipment.

The integrated PROM programmer can accept standard and high-speed versions of the 2716, 2732, 2732A, 2764, 27128, and 27256. A batch debug command language in the SA700 system allows the user to develop and execute entire debugging routines on the emulator. The system handles all phases of software debugging and system integration. To be available in June, the SA700 sells for $9,995.

Sophia Computer Systems Inc., 3337 Kifer Rd., Santa Clara, Calif. 95051. Phone (408) 733-1571 [Circle 364]

6½-digit multimeter fits well in ATE situations

Designed for systems applications, the model 193 6½-digit digital multimeter provides the measurement speed, IEEE-488-bus flexibility, and measurement sensitivity demanded by automated test applications. Four scale resolutions are available with reading rates to 1,000 readings/s at 3½ digits.

Sensitivity is to within 100 ns, and accuracy (for one year) is to within 0.009%. The instrument's nine functions include dc volts, two-wire and four-wire ohms, decibels, resistance-temperature-detector temperature linearization, low-frequency ac from 0.1 to 10 Hz, true root-mean-square ac volts, dc amps, and true rms ac amps.

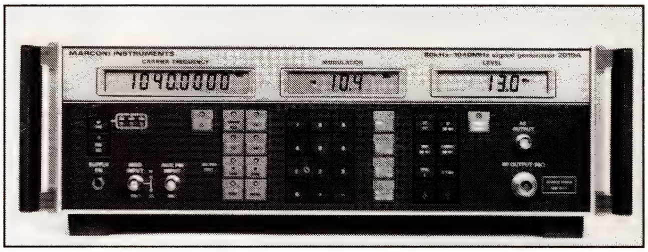
The instrument's 14-segment LED display is easy to use and can display operator messages defined by the programmer. Its 500-point nonvolatile data buffer retains data during power loss. Base price of the instrument is $2,100.

Keithley Instruments Inc., 28775 Aurora Rd., Cleveland, Ohio 44139. Phone (216) 248-0400 [Circle 340]

Signal generators enhanced with more memory, features

Two enhanced signal generators, the models 2018A and 2019A, now include such features as phase modulation, variable-level audio-frequency output, auxiliary FM input, nonvolatile-memory doubling to store and recall instrument settings, and a choice of optional external reference frequencies.

The 2018A has a frequency range of 80 kHz to 520 MHz, and the 2019A has a range of 80 kHz to 1 GHz. Microproces-



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sor control provides simple and rapid operation by direct keyboard entry of settings and the nonvolatile memory, which can store up to 100 settings. Optional IEEE-488 programmability extends the instruments' range of applications to automatic test equipment.

Available 60 to 90 days after ordering, the 2018A and 2019A each sell for $5,400.

Marconi Instruments, 3 Pearl Ct., Allendale, N.J. 07401. Phone (201) 934-9050 [Circle 341]

Interface converts small VAX into instrument controller

With an IEEE-488 interface, the Microvax I 32-bit multiuser microcomputer becomes a small yet powerful engineering work station for the design engineer, real-time data acquisition and control system for the laboratory, or the foundation of an automated test system for the production floor. The GPIB11V-2 is a dual-height, Q-bus-compatible board that implements all IEEE-488 controller functions.

Using direct memory access, data can be transferred over the IEEE-488 bus between system memory and programmable devices at speeds up to 330-K bytes/s. IEEE-488 functions implemented on the GPIB11V-2 include the capability to be a test-system controller, controller, talker, or listener.

Software support for the GPIB11V-2 on the Microvax is provided under the MicroVMS operating system. The software includes a handler that is installed under MicroVMS, subroutines allowing applications programs to be written in Fortran or Macro, and an interactive control program. The handler implements a set of functions to communicate with, manage,

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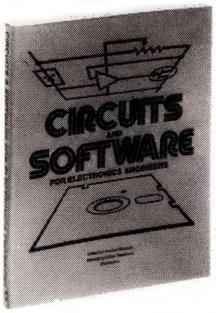

Edited by Howard Bierman, Managing Editor, Technical—*ElectronicsWeek Magazine*

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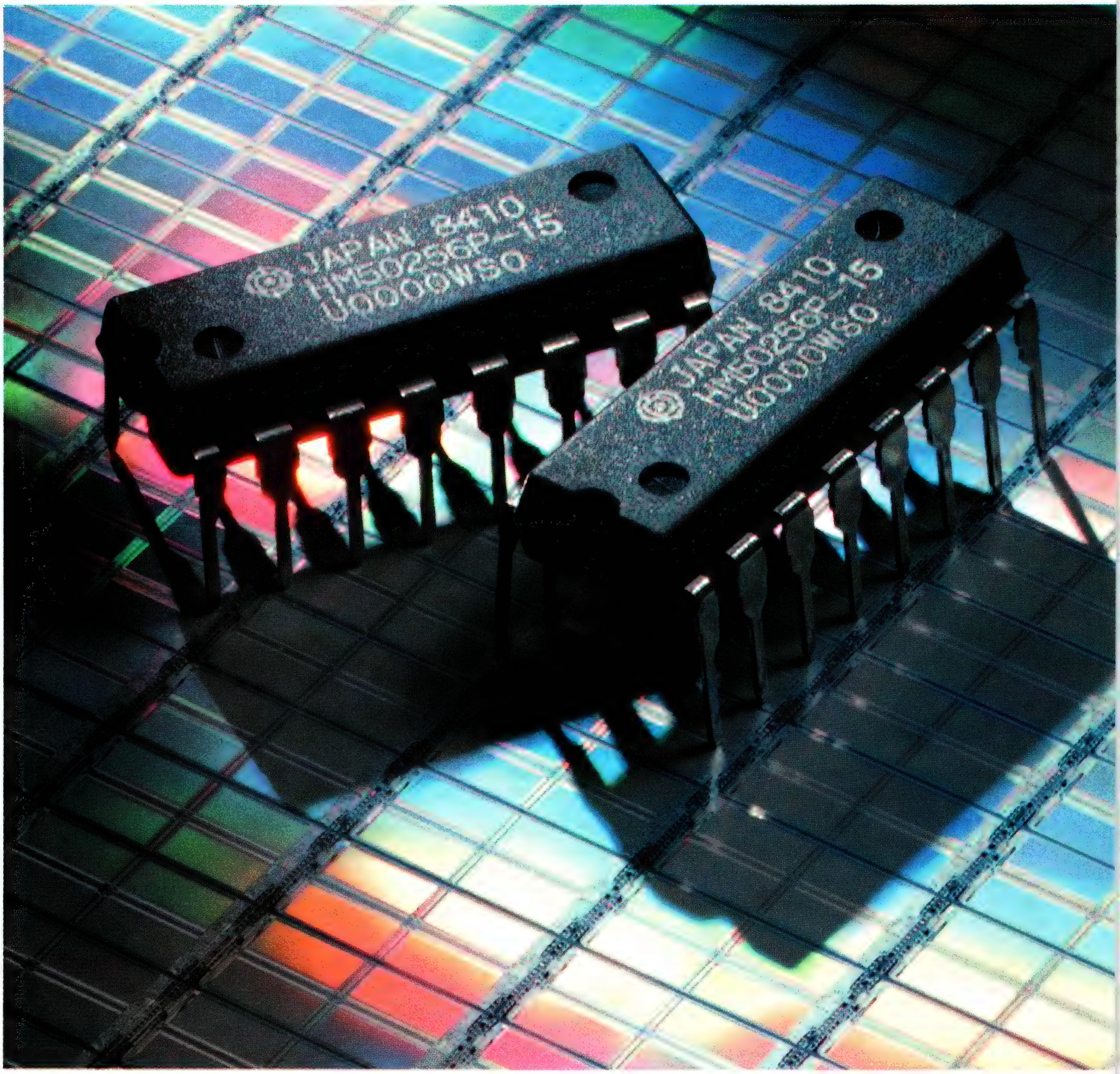

The newest addition to Hitachi's line-up of dynamic RAMs is the 256-kbit HM50256, taking full advantage of Hitachi's own 2-micron process technology.

THANKS TO HITACHI'S ADVANCED R&D AND PRODUCTION CAPABILITIES, THE HIGH-PERFORMANCE DRAMS YOU NEED ARE

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the leading edge of the semiconductor field, ariety of dynamic RAMs are offered by Hitachi, ame renowned throughout the industry for ality, reliability and availability. Here are the ught-after products and dependability you mand, based on fine-pattern process tech- logy and circuit design expertise second none.

ith up to 256 kbits

e HM50256 features a 262,144 word × 1 bit nfiguration. In addition to conventional high- eed page-mode operation, with access times 120, 150 or 200 ns, it provides memory refresh three modes: $\overline{\text{RAS}}$ only, $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$, d hidden refresh. A nibble-mode type, the 150257, is also available for 4-bit serial read/ ite applications. Both types come in a standard -pin DIP for drop-in compatibility with popular K DRAMs.

In fact, compatibility is a key consideration Hitachi's development of new DRAMs. As the nd shifts toward larger, faster, more powerful emories, Hitachi assures DRAM users of conti- ity of design and performance specifications— oint that's been proven again and again as Hitachi has moved up the scale from its first 1-kbit DRAM to today's 256-kbit units.

The newest products are the results of Hitachi's own 2-micron process, which packs more memory into highly dependable devices. That means exceptional power and compactness in office systems, portable electronic devices, and every application where speed and performance are crucial.

With extensive R&D

Just introduced were the HM50464P and the HM50465P 18-pin 256K DRAMs organized with 64 kword × 4 bit in page mode and nibble mode, respectively. What's more, Hitachi engineers are working on plastic leaded chip carriers (PLCCs) to further reduce unit size.

Such innovations as these are possible because of Hitachi's ongoing commitment to research and development activities, involving the talents of some 16,000 researchers in electronics and other fields. So when you're ready for the best in DRAM technology, deal with a leader. Contact Hitachi.

HITACHI

more information:
hi, Ltd., Semiconductor & IC Div., New Marunouchi Bldg., 5-1 Marunouchi 1 chome, Chiyoda-ku, Tokyo 100, Japan Tel: Tokyo (03) 212-1111
hi Electronic Components Europe GmbH, Hans-Pinsel-Strasse, 10A, D-8013 Haar/Munich, W. Germany Tel: 089-46140
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hi America, Ltd., Semiconductor & IC Sales & Service Div., 2210 O'Tool Avenue, San Jose, CA 95131, Tel: 408-942-1500

Circle 101 on reader service card

and control equipment connected to the interface.

The GPIB11V-2 interface sells for $1,495; the MicroVMS software package sells for $500. Delivery is from stock.

National Instruments, 12109 Technology Blvd., Austin, Texas 78727. Phone (512) 250-9119 [Circle 343]

Lightweight multicounter is accurate to within 0.003%

Capable of frequency, period, totalize, ratio, and time-interval measurements, the WD-575 multicounter offers accuracy to within 0.003% and stability to within 0.002%. Combining CMOS, TTL, and low-power Schottky LSI technologies, the instrument comes equipped with three signal inputs as well as a switchable attenuator to reduce high-amplitude signals to one tenth. A switchable low-pass filter passes or rejects signals below 10 MHz.

Suitable for applications in technical, trade, and corporate repair centers, the instrument measures 3⅝ by 8¾ by 11 in. and weighs 3½ lb. Available four weeks after ordering, the WD-575 sells for $479.

VIZ Manufacturing Co., 335 E. Price St., Philadelphia, Pa. 19144. Phone (215) 844-2626 [Circle 342]

Synthesizer tracks phases accurately

The low-cost 650 precision variable-phase synthesizer performs multichannel phase tracking to within 0.005° below 1 kHz. Accurate phase relationships between signals are critical for the accuracy and performance of a number of products.

Two 6803 microprocessors and one 68000 processor control the 5¼-in.-wide instrument. The 68000 is used as a coprocessor and as the computational portion of the phase accumulator. The user can preset the phase relationship of each channel to every other channel.

The phase-detection method used is an enhanced version of quadrature phase detection, which is highly accurate even at frequencies over 100 kHz. In addition, the synthesizer includes a high-accuracy peak detector so that it can characterize its own filter characteristics and store compensation values in nonvolatile RAM.

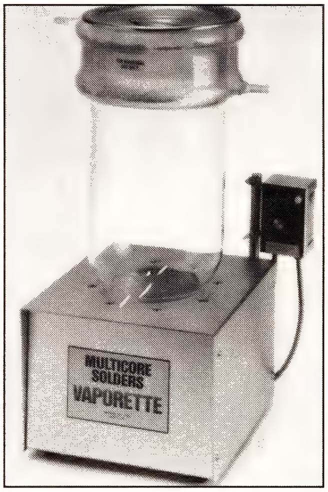
The 650 can be used as a phase standard or for calibration of other phase standards in such applications as phase meters, synchro/resolver-to-digital converters, phase-locked loops, and phased array sonar.

The 650's output capability is 40 V peak to peak. Frequency range is 100 μHz to 2 MHz, with a resolution of 100 μHz (10 digits). Waveforms available include sine, square, triangle, and square and triangle variable duty cycle. The dual-channel unit sells for about $9,000; a four-channel option brings the figure up to about $12,000. Delivery takes up to 12 weeks.

Wavetek San Diego, 9045 Balboa Ave., San Diego, Calif. 92123. Phone (619) 279-2200 [Circle 344]

Tabletop soldering system is good for small runs

A portable tabletop system that can be used for vapor-phase reflow soldering has a transparent, glass-walled chamber so users can observe the process. Suitable for laboratories, research, and low-volume production and prototype applications, the Vaporette processing chamber has a 5½-in. diameter and stands 8 in. high.



The relatively small quantity of liquid required for operation makes it extremely cost-effective and economical. It can be brought to operating temperature quickly, so it can be used intermittently. A water-line faucet and small circulating pump or gravity feed system are all that is needed to cool the system.

Priced at $995, the system is furnished with FC70 Fluorinert (or equivalent) heat-transfer liquid and solder-cream kit of various alloy and flux combinations. A stainless-steel screen is optional.

Multicore Solders, Cantiague Rd., Westbury, N.Y. 11590. Phone (516) 334-7997 [Circle 346]

Disk drives increase wire wrapper's speed

With their 8-in. floppy-disk drives, the SW-1000 series of semiautomatic wire-wrapping systems allow positioning data to be stored, thus increasing speed, accuracy, and durability over systems that use paper tape. The system can be used for retrofitting existing paper-tape based systems.

The disk stores up to 250-K bytes, which is approximately 10,000 wiring sequences. Data is stored in IBM 3740 format and the disk can be created on the system or downloaded to it over an RS-232-C interface.

Data is stored on the disk as a paper-tape image, so there is no need to convert existing paper-tape data into a new disk format: the image can simply be copied onto the disk. The wire-wrapping systems come with a control panel, X-Y wiring table, a 40-tube wire storage bin, and a floppy-disk controller that uses an 8-in. drive and Z80 processor for system control functions. The series consists of three models: the SW-1000

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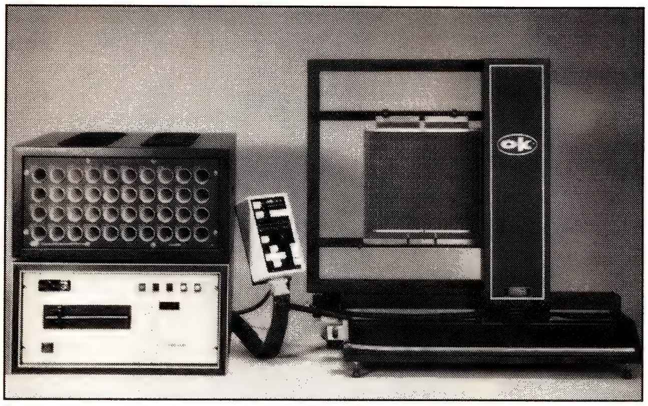
Circle 91 on reader service card



has a 20-by-20-in. wiring area; the SW-2000 and SW-2000L have 40-by-30-in. wiring areas.

The SW-2000L includes an electric lift base. All systems in the series offer positioning speeds of 10 in./s and positioning accuracy to within 0.0025 in. Prices start at $8,595, and delivery takes up to four weeks.

OK Industries Inc., 3455 Conner St., New York, N.Y. 10475.
Phone (212) 994-6600 [Circle 345]

3½-in. drives consume just 3.2 W in write operations

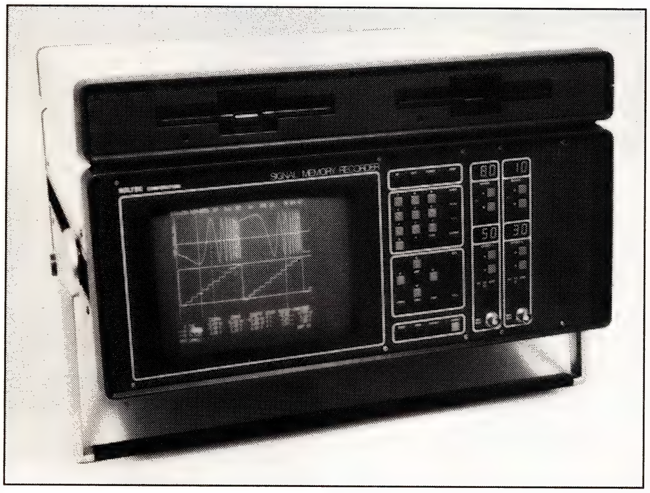
A trio of 3½-in. microfloppy-disk drives, with storage capacities of 250-K bytes, 500-K bytes, and 1 megabyte, consumes very little power in write operations—3.2 W at a maximum. All of the drives, the JU-313, JU-323, and JU-363, are fully compatible with popular 5¼-in. floppy-disk-drive interfaces.

Measuring 104 by 161 by 32 mm, the drives are about one fifth the volume and one third the weight of conventional 5¼-in. drives. The drives have a 3-ms track-to-track access time. Prices start at $125 each in large quantities, and the drives can be delivered in eight weeks.

Panasonic Industrial Co., Computer Components Division, One Panasonic Way, Secaucus, N.J. 07094.
Phone (201) 348-8044 [Circle 347]

Signal memory recorder handles 16 channels of data

Instrumentation engineers who need to handle large amounts of analog data with a minimum of operator intervention will find the SMR2 programmable signal memory recorder fast and easy to operate. The SMR2 converts from 1 to 16 channels of analog signals to digital format and stores up to 64,000 data samples in each channel.



Channels can be connected in parallel or cascaded to store more data than can be accommodated on eight IBM Personal Computer or Apple II floppy disks, the company claims. After capturing data, the SMR2 can filter, analyze, or display it.

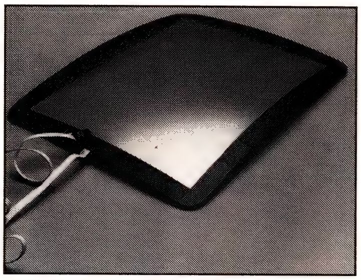
The recorder can put out the data over standard data buses or on X-Y, video, or multichannel oscillograph recorders for hard copy. The complete process can be controlled through the CP/M operating system and either Fortran, Basic, or Pascal.

Soltec Corp., 11684 Pendelton St., Sun Valley, Calif. 91352.
Phone (818) 767-0044 [Circle 348]

Improved touch-sensitive screen has lower profile

An improved touch-sensitive screen for use with computer displays in interactive applications features a lower-profile border and costs less than the company's earlier version. The E274 touch screen is a transparent display overlay that helps simplify interaction with computerized systems.

The new model, like its E270 predecessor, is a resistive membrane screen. It uses an electrically resistive coating on a glass substrate as a voltage divider for both the X and Y axes. Voltage for each axis is picked off at the point of touch by a conductive coating on the inside of a plastic contact sheet stretched tightly over the glass. The contact sheet is held above the glass by the company's patented separator-point technique.



The E274 differs from the E270 in that it does not require diodes to be mounted around the edge of the glass to ensure proper linear voltage drops across the resistive coating. The E274's design replaces the diode switching circuit by a simple resistor network and special contact geometry to achieve the same high linearity achieved in the E270. The elimination of the diode strings reduces the manufacturing labor and cost, and produces a low-profile border.

The screen provides a resolution of 4,000 by 4,000 points across the displayed image. In large quantities, the E274 is priced at $100 each and is available in 30 to 60 days after receipt of order.

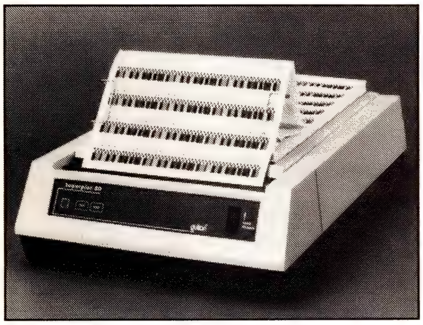
Elographics Inc., 105 Randolph Rd., Oak Ridge, Tenn. 37830.
Phone (615) 482-4100 [Circle 349]

Plotter serves computer and instrument recording needs

Designed for both computer- and instrumentation-graphics hard-copy applications, the Superplot-80, an 80-column thermal printer/plotter, produces graphics at a speed of 71 dot-lines/s and near letter-quality alphanumerics at a speed of over 500 characters/s. The printhead has a resolution of 100 dots/in.

The Superplot-80 features a full 96-character ASCII set in a variety of fonts, complete with true descenders. A set of 32 international characters is also included.

Provided with page-level vector graphics, the Superplot-80 is able to format a graphic display based on coordinates that are generated by the host system. This feature reduces communication time and eliminates the need for the host to convert the display to raster form before communicating with the combi-



nation of printer and plotter.

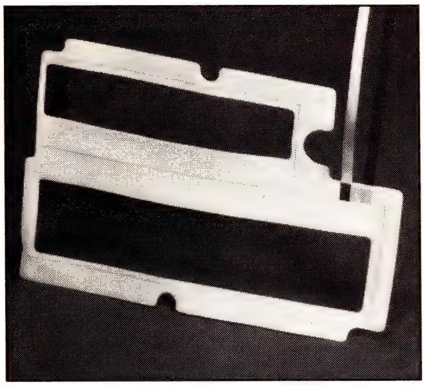
The plotter has an 8-in.-wide printable field on an 8½-by-11-in. thermal chart paper. The desktop version of the instrument uses fan-fold paper while the panel-mounting model uses roll paper.

Gulton Industries Inc., Graphic Instruments Division, Gulton Industrial Park, East Greenwich, R.I. 02818.
Phone (401) 884-6800 [Circle 350]

Electroluminescent lamps resist humidity

Thin, custom-configured, and lightweight, electroluminescent (EL) lamps consume little power and generate virtually no heat.

Operating on the same principle as capacitors—alternating current between two conductors separated by a dielectric layer—the flat-panel lights can be as thin as 15 mils. They are constructed as laminated layers of conductive, dielectric, and protective materials, and the outer layer, a proprietary protective material, allows the lamp to be sealed without the edge margin required for conventional lamps—thus providing lighting to the lamp's edge.



The green lights can be filtered with adhesives to provide alternative colors, as might be needed in such applications as airplane cockpits equipped for night flight. In critical lighting situations, the EL's gradual degradation or dimming provides a warning that the lamp needs replacement; catastrophic failures are eliminated. Available in standard or cus-

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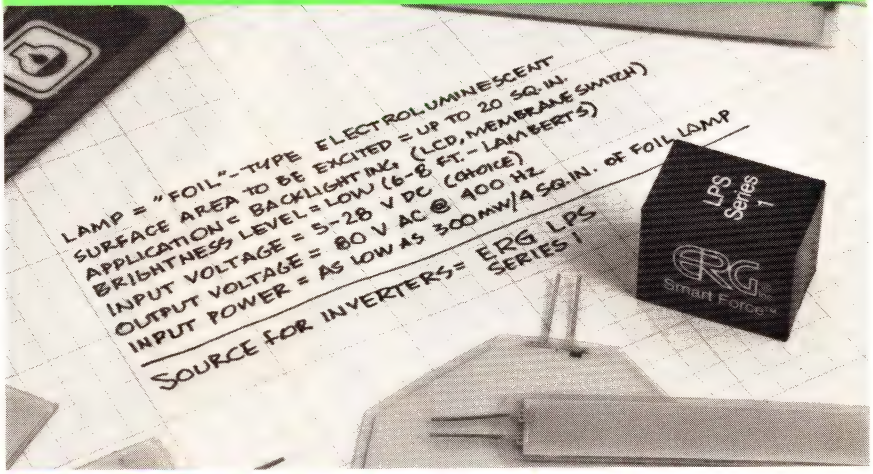
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APPLICATION = BACKLIGHTING (LCD, MEMBRANE SWITCH)
BRIGHTNESS LEVEL = LOW (6-8 FT.-LAMBERTS)
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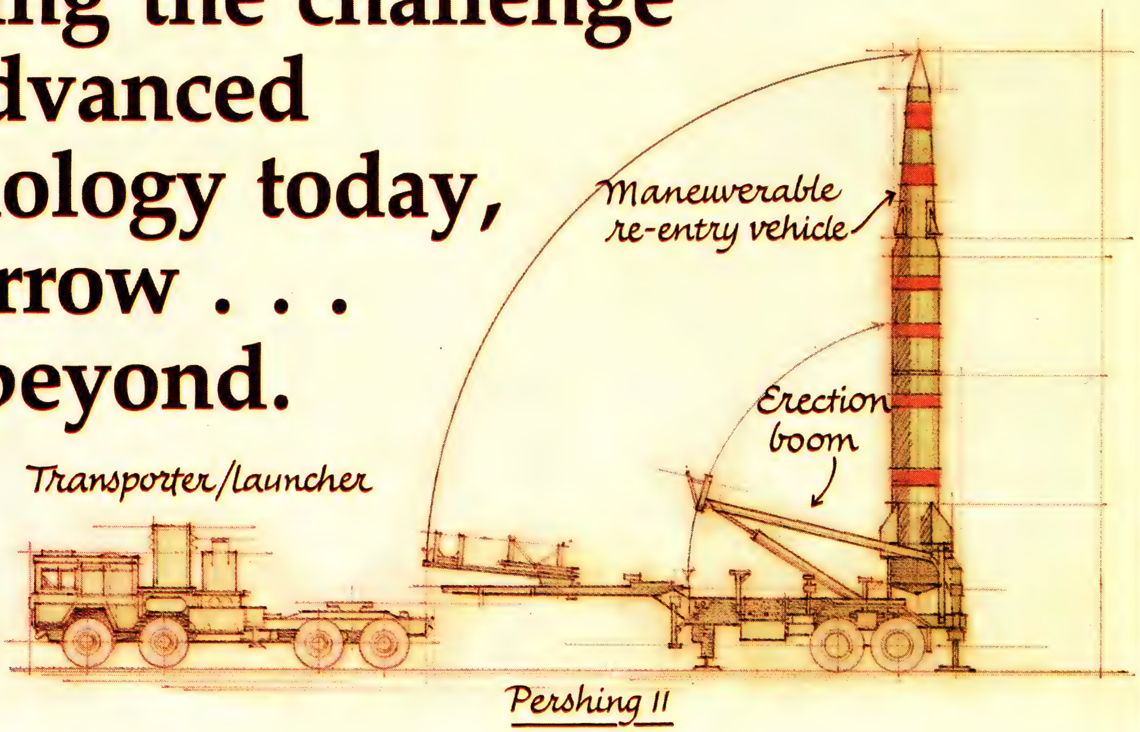

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- Quality Engineers
- Facility Engineers
- Composite Engineers
- Robotics Engineers

tom configurations, delivery of standard and prototype models can be made in as little as one week.

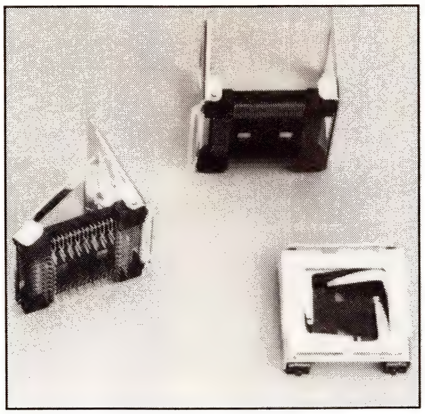
Pricing, which is based on the lamps' surface area and figured by the square inch, also can vary with shape, complexity, cutouts, filters, and adhesives required.

Rogers Corp., 2001 W. Williams Field Rd.,
Box 700, Chandler, Ariz. 85224.
Phone (602) 963-4584 [Circle 352]

Chip-carrier sockets stand just 0.02 in. off surface

A series of sockets for leadless chip carriers is designed to interconnect microprocessors and gate arrays, as well as high-density custom logic devices.

The Ansley sockets provide a buffer between the package and the interconnecting substrate. Solder-tail and surface-mount contacts for printed-wiring-board interface and gold-plated beryllium copper contacts are built in, and a unique cover design latches the chip carrier to the socket. A minimum 0.02-in. standoff eases cleaning, visual inspection, and probe access to contact leads after installation.



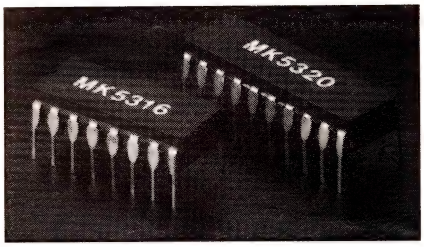
The sockets accept standard leadless Type A packages with 0.05-in. centerlines (68 or 84 positions) and packages with 0.025-in. centerlines (132 or 164 positions). Pricing and delivery information was not available at press time.

Thomas & Betts Corp., Electronics Group,
920 Route 202, Raritan, N.J. 08869.
Phone (201) 469-4000 [Circle 353]

Single chip boasts codec and pcm filter functions

A family of coder/decoders combines both codec and pulse-code-modulation filter functions on a single IC.

Manufactured in a low-power, silicon-gate CMOS analog process, the monolithic MK5316 provides accurate capacitor arrays (necessary for per-channel, voice-frequency codecs and pcms) thanks to its double-poly design. Synchronous or low-noise asynchronous operation with serial data rates from 64-kb/s to 4.096 Mb/s are featured.



Available in a 16-pin hermetic DIP, the device also comes in a 20-pin configuration—the MK5320—with built-in power amplifiers that drive either balanced or unbalanced loads. Both models operate on 40 mW and consume less than 1 μW when in standby mode.

The MK5316 sells for $9.50 in quantities of 1,000 or more; the MK5320 costs $10 in the same quantity.

Mostek Corp., 1215 W. Crosby Rd., Carrollton, Texas 75006.
Phone (214) 466-6000 [Circle 362]

Toroidal transformers meet IEC, VDE insulation standards

Meeting the insulation requirements of the International Electrotechnical Commission as well as the Verband Deutscher Electrotechniker, the Budget Range line of toroidal power transformers can be supplied with dual 120-V primary windings or with 110-, 220-, or 240-V single-winding primaries.

The transformers can be operated at +120°C for brief periods without deterioration. All power ratings (which include 30, 60, 100, 160, 230, 330, and 530 VA) have single-hole fixing and use a dished washer and protection pads.

The Budget Range can be operated under derated conditions at a lower tem-

perature with improved regulation. Delivery is from stock, and pricing is dependent on the desired configuration.

Avel-Lindberg Inc., Peacock Alley 116, 1 Padamaram Rd., Danbury, Conn. 06810. Phone (203) 797-8698 [Circle 351]

Switching power supplies have 3,750-V isolation

A complete family of single- and quad-output switching power supplies is designed to comply with the safety requirements and emission specifications of a full range of standards organizations.

V Series single-output units are available with power ratings of 120, 180, 270, and 360 W; quad-output models come with 300, 400, and 500 W ratings. Output voltages are ± 5, ± 12, ± 15, and ± 24 V in various combinations. The ultracompact models deliver 2.8 W/in.^{3}.

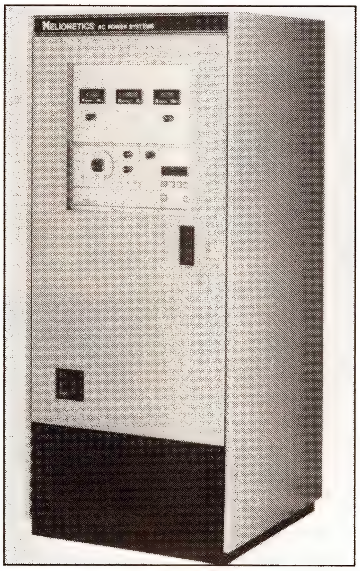
The switching power supplies feature 3,750 V ac isolation. Primary to secondary safety spacing is 8 mils, and 4 mils from primary to grounded circuits. Leakage current of 0.75 mA, conversion frequency of 80 kHz, and 80% typical efficiency are standard.

The power supplies, which are guaranteed for three years, accept inputs of 90 to 132 V ac or 180 to 264 V ac. Available within eight weeks from receipt of order, production-quantity prices range from $90 to $180 for single-output units and from $215 to $322 for quad-output models.

Deltron Inc., P.O. Box 1369, Wissahickon Ave., North Wales, Pa. 19454. Phone (215) 699-9261 [Circle 354]

Power source has 3-phase variable operating modes

Featuring three-phase variable-control operating modes ranging from 45 to 500 Hz, the model 3121-AVR3 48-kVA ac power source relies on high-frequency pulse-width modulation for high power density and quiet operation.



Load regulation and distortion on the power source are approximately to within 1% with a 150% surge-handling capability. It operates in temperatures between 0°C and +55°C, and features modular construction, self-healing, and self-diagnostic circuitry.

The 3121-AVR3 power source is housed in an 875-lb package that measures 29 by 34 by 72 in.

Helionetics Inc., 17312 Eastman St., Irvine, Calif. 92714. Phone (800) 421-7915 [in Calif., (714) 261-8313] [Circle 356]

Small dc-to-dc converter provides up to 6 W

A line of 24-V input dc-to-dc converters offers low noise with power outputs of 3 and 6 W with single outputs of 5, 12, and 15 V, in addition to dual outputs of ± 12 and ± 15 V.

The low-profile converters measure 0.375 by 2 by 2 in. and are set into six-sided shielded packages. Proprietary internal filtering circuits minimize the introduction of current noise back into the 24-V power bus. Output noise is typically 10 mV for the converters, which are equipped to operate in a temperature range of −25°C to +80°C.

Featuring a five-year guarantee, small quantities of the converters are available from stock and are priced at $88 each. Discounts to original-equipment manufacturers are available.

Calex Mfg. Co., 3355 Vincent Rd., Pleasant Hill, Calif. 94523. Phone (415) 932-3911 [Circle 355]

Multiple-output switcher has range of standard features

A line of 800-W multiple-output switchers features a broad range of systems-interface facilities to provide a host system with control and monitor capabilities over its power supplies.

Remote inhibit, remote margining of the main output, remote sense on all outputs, ac power-fail detection, and out-of-tolerance detection are all made possible by the system. Available in dual-, triple-, and quad-output configurations, its main 5-V output is rated at 120 A load. Up to three auxiliary outputs can be provided in a wide selection of voltage and current ratings.

Packed into an industry-standard 5-by-8-by-12.85-in. case, the 800-W series offers typical efficiency of 70% to 75%. Input is field-selectable on the front panel for operation in the range of 90 to 132 V ac or 180 to 264 V ac.

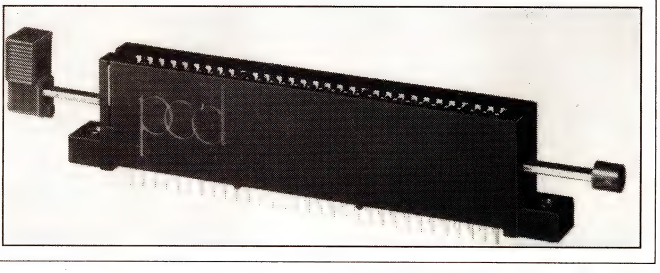
Delivery is from stock, and in quantities up to 24, the system costs $990.

Computer Products Inc., Power Products Division, 2981 Gateway Dr., Pompano Beach, Fla. 33069.
Phone (305) 974-2442 [Circle 363]

ZIF connector provides 31 contact pairs for PC bus

A zero insertion force (ZIF) edge-card connector can be configured with 31 contact pairs for the IBM PC or similar bus applications. The standard model comes with 36 pins on a side, providing 72 contacts. The connectors' contact spacing measures 0.100 in. Two versions for double-sided pc boards meet both option-board testing (90-μm gold contact plating) and production (30-μm plating) requirements.

A Kelvin test/burn-in socket is also available. The socket provides independent contacts on each lead for four-lead TO-



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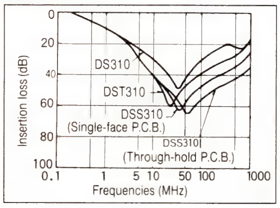

■RATINGS

Part Number	Capacitor			Ferrte Core.
	Capacitance	Rated Volt.	Temp. Char.	
DSS310-55Y5S220M DSS310-55Y5S470M DSS310-55Y5S101M	22pF ±20% 47pF ±20% 100pF ±20%	100V	±10%	inside
DS 310-55Y5S271M DST310-55Y5S271M DSS310-55Y5S271M	270pF ±20%	100V	±10%	none outside inside
DS 310-55Y5S222M DST310-55Y5S222M DSS310-55Y5S222M	2200pF ±20%	100V	$^{+20}_{-30}$%	none outside inside
DS 310-55Y5S223S DST310-55Y5S223S DSS310-55Y5S223S	22000pF $^{+50}_{-20}$%	50V	$^{+20}_{-30}$%	none outside inside

※Disc-type "EMIFIL®" has 7A max. of current capacitance between terminals and 2.5±0.5mm of distance between terminals.

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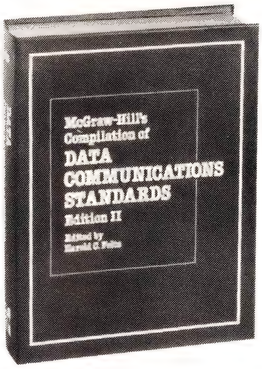
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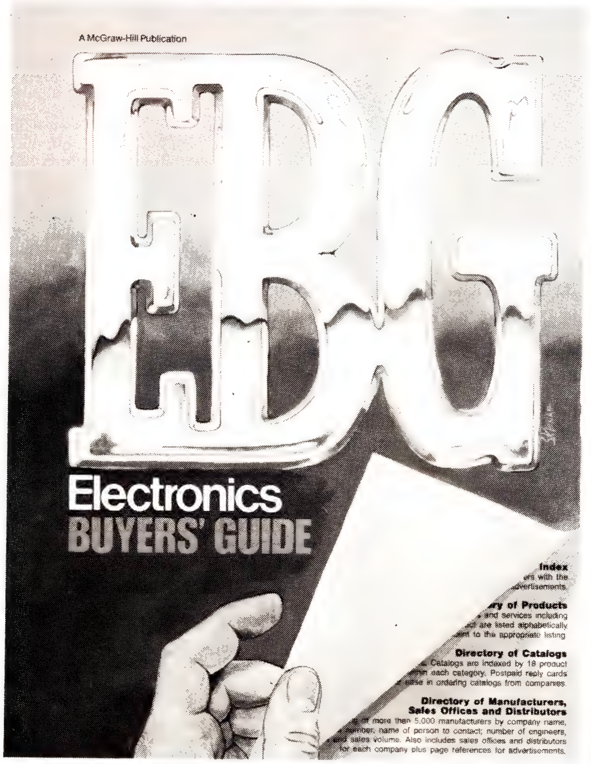
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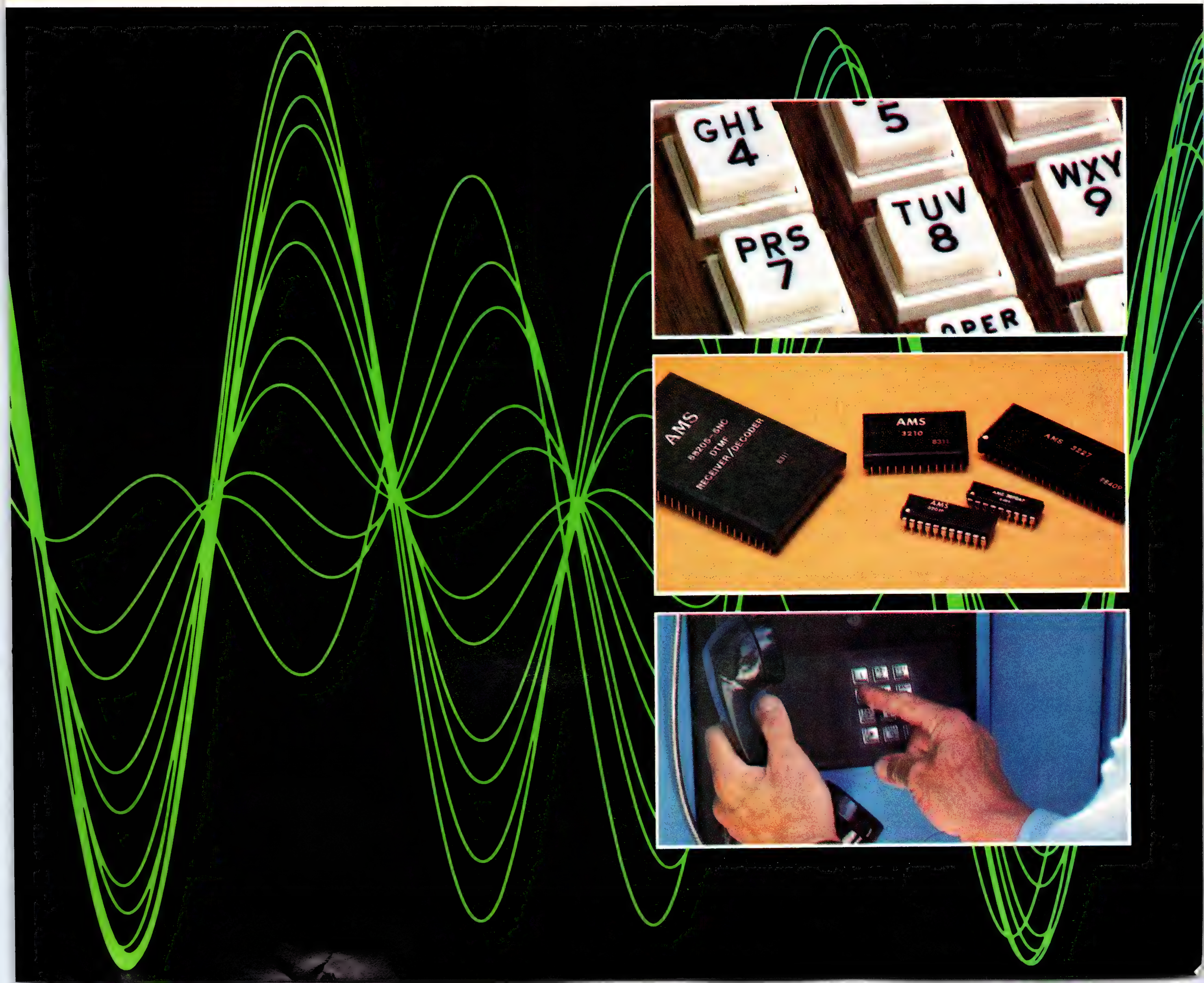


46-type packages. The lead pattern is only 0.10 in. in diameter.

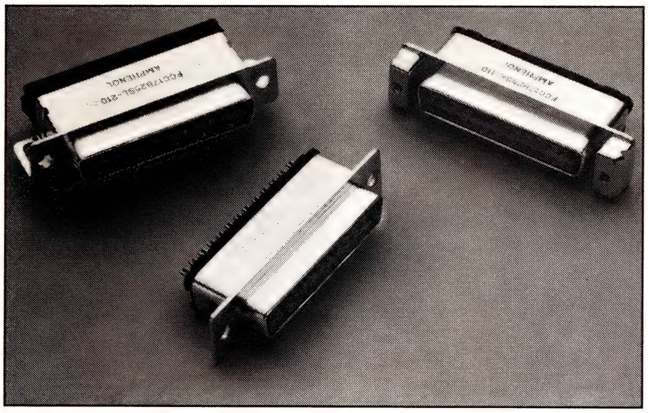
In 100-piece quantities, the connectors list for $8.89 apiece. Delivery takes four weeks.

PCD Inc., 5 Lowell Ave., Winchester, Mass. 01890.
Phone (617) 721-1280 [Circle 358]

Connector's chip capacitor filters out EMI and RFI

Designed for computer and telecommunications applications, series D-subminiature connectors feature a stress-isolated capacitor filter network to screen out electromagnetic and radio-frequency interference. The FCC 17 series filter connectors can be used to replace any of the company's other D-subminiature designs.

The connectors use barium-titanate chip capacitors and have an operating range of –40°C to +85°C. A variety of insertion-loss and band-pass characteristics is available depending on the capacitance value. The connectors also come in 9-, 15-, 25-, and 37-pin configurations.



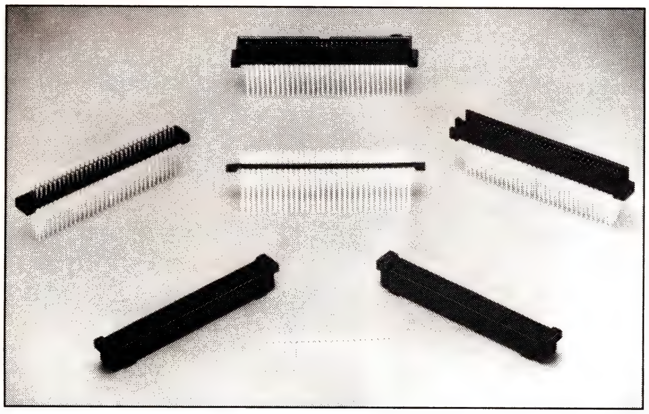
The connectors sell for 30¢ per line in original-equipment-manufacturer quantities of 10,000 pieces.

Amphenol Products, 4300 Commerce Ct., Lisle, Ill. 60532.
Phone (312) 983-3540 [Circle 357]

Male headers meet Euroconnector Mil-Spec

A series of male header assemblies meets MIL-C-55302 Euroconnector specifications for high-density packaging. The series 416 is made up of two-piece HDI (high-density interconnections) on 0.100-by-0.100-in. grids.

The series offers five basic configurations: discrete press-in with inverse Deutsches Institut für Normung shroud and three-level wrapped-wire tails; inverse DIN shroud pressed over controls; discrete headers with shrouds; loose shrouds that are placed over the wrapped-wire tails; and one-, two-, three-, and four-row feed-through and feed-to headers. Polarized shrouds, variable mounting styles, and an ejector latching system are also available.



The price of the connectors ranges from 2¢ to 6¢ per contact. Delivery takes four to six weeks.

Methode Electronics Inc., 7444 W. Wilson Ave., Chicago, Ill. 60656. Phone (312) 867-9600 [Circle 359]

Switches offer snap-in bezel for front-panel mounting

A snap-in bezel that mounts from the front of a control panel is now available with wiping- and butt-contact push-button switches.

The panel-mount switches are available in a variety of configurations: single-pole, single-throw; single-pole, double-throw; and double-pole, double-throw. Switches can be mated with a standard square bezel or a rectangular version that offers a choice of one or two snap-fit LED holes for applications requiring indicator lights.

The square model mounts in a ¾-in. hole, and the rectangular unit fits a ¾-by-1-in. hole. The bezels are finished in matte black, and designers can choose from six button-cap colors. In 100-piece quantities, switches are priced from $2.51 to $6.90.

Grayhill Inc., 561 Hillgrove Ave., La Grange, Ill. 60525.
Phone (312) 354-1040 [Circle 361]

125-mA keyswitches light up with a variety of options

A line of LED-illuminated single-pole single-throw keyswitches offers designers wide choices of color, legend, and illumination. The normally open momentary-action switches are rated at 125 mA.

The modular keyswitches are designed for mounting in a 0.1-in. printed-wiring-board layout grid using center-to-center spacing of 0.5-in. Compatible with wave-soldering and immersion-cleaning techniques, nonilluminated versions are also available.

Typical pricing for a standard module keyswitch including LED, key cap, lens, and hot-stamped legend is $1.19 when purchased in 1,000-piece quantities. Delivery is from stock but may take up to eight weeks.

Centralab Inc., Hwy. 20 W., P.O. Box 858, Fort Dodge, Iowa 50501. Phone (515) 573-1300 [Circle 360]

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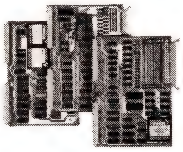

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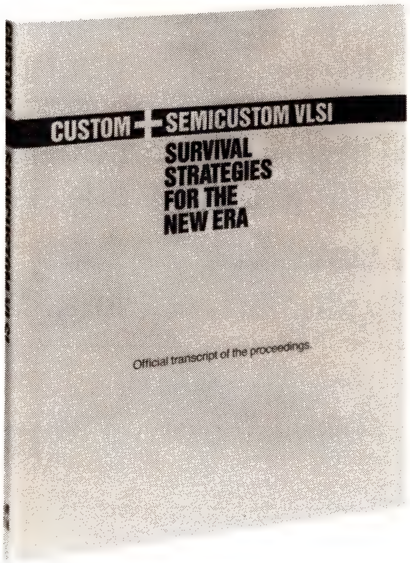
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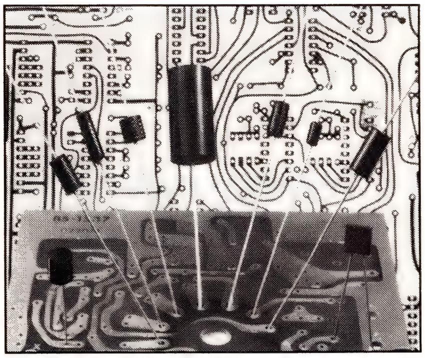
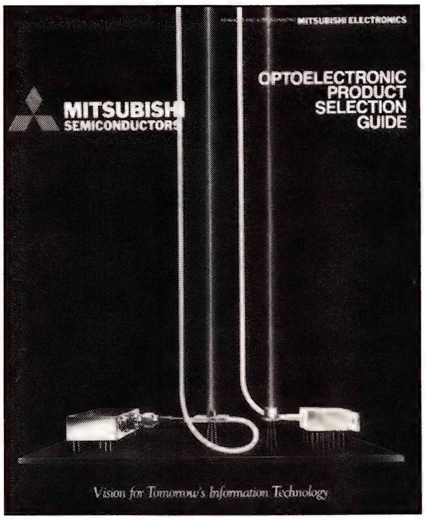
Genius for sale. The Institute of Electrical and Electronics Engineers Press has published an anthology of 67 papers under the title of *Marketing Technical Ideas and Products Successfully!* Organized into such areas as industrial marketing, marketing programs and their effectiveness, methods, and producing marketable copy, topics range from the marketing responsibilities of the engineer and the scientist to how to measure advertising's sales effectiveness. The book also covers customer and client needs through all phases of product development, including sales and service. Priced at $48.95 ($29.40 to IEEE members), this 400-page book, catalog number PC01792, can be ordered postpaid from the IEEE Service Center, 445 Hoes Lane, Piscataway, N.J. A $2 billing charge is added to all ship-and-bill orders. [Circle 422]

Live wire. This catalog of wirewound resistor products will supply the design engineer or buyer with information on axial-lead military and commercial grade or industrial-type resistors, pc commercial or industrial-type resistors, and power wirewound resistors. A design guide shows recommended-use conditions, and a list of general specifications is also included. For a free copy of catalog VW 1000, write to Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, Pa. 19355. The telephone number is (215) 644-1300. [Circle 425]



Clear as glass. Two new product selection guides highlight Mitsubishi Electronics America Inc.'s optical and linear products. One of them is an eight-page optoelectronics product selection guide covering the company's discrete optical parts and fiber-optic modules. The guide includes wavelength charts, optical and electrical characteristics, and a product application section. The second brochure is a four-page guide listing the firm's industry-standard linear ICs, including transistor arrays; dual, quad, and J-FET operational amplifiers; voltage comparators; voltage regulators; and timer ICs. Both publications are available at no charge by writing to the Semiconductor Division, located at 1050 E. Arques Ave., Sunnyvale, Calif. 94080, or calling (408) 730-5900. [Circle 428]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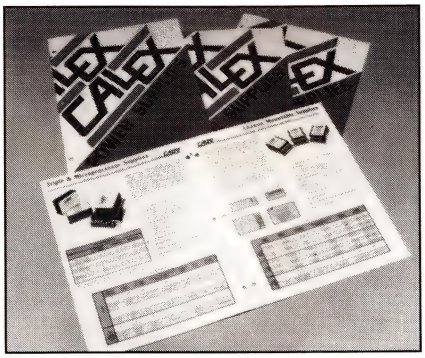
Power up. The 1985 edition of this power-conversion-products catalog features 52 modular encapsulated, low-profile dc-to-dc converters. Also appearing are 44 modular ac-to-dc encapsulated power supplies, the manufacturer's adjustable-output-voltage model 4130 transducer power supply, and the model 829 ac line-voltage monitor. All products listed carry a five-year warranty. These products are available from stock, and original-equipment-manufacturer quantity discounts are offered. To receive a copy of the catalog, contact Calex Manufacturing Co., 3355 Vincent Rd., Pleasant Hill, Calif. 94523. The telephone number is (415) 932-3911. [Circle 426]



Best test. A 20-page short-form catalog describing over 50 test instruments, including digital and analog meters, isolated ac power sources, signal generators, dc power supplies, and universal counters, gives product applications and specifications. The latter include voltage and current ranges, meter accuracy, measuring range, and resolution. For a free copy of this 1985 catalog, call VIZ Test Equipment at (800) 523-3696 (in Pennsylvania, at [215] 844-2626), or write to the company at 335 E. Price St., Philadelphia, Pa. 19144. [Circle 424]

Powerful. Of interest to consumer and industrial power control engineers, *Power Transistors: Device Design and Applications* thoroughly explains the latest developments in power-transistor technology and covers the application of these new devices to power conditioning. The traditional bipolar power transistor is discussed and there is a special focus on emerging technologies: gate turn-off thyristors, power MOS FETs, static induction transistors, field-controlled thyristors, and MOS insulated-gate thyristors. The book is available for $51.95 ($31.20 for IEEE members). It may be ordered from the Institute of Electrical and Electronics Engineers Service Center, 445 Hoes Lane, Piscataway, N.J., 08854. [Circle 427]

Once and for all. Approximately 8,000 ANSI-approved standards are listed in this year's *Catalog of American National Standards.* The standards provide dimensions, ratings, terminology, symbols, test methods, and performance and safety requirements of materials, equipment, components, and products. The catalog covers acoustical, electrical, electronic, and nuclear standards, and the fields of information systems, measurement and automatic control, and medical devices, among others. Nonmembers of the American National Standards Institute Inc. can purchase the catalog for $10 by calling the institute at (212) 354-3315 or writing to 1430 Broadway, New York, N.Y. 10018. [Circle 429]

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Watch for the May issues of Electronics Week. They'll contain expanded recruitment sections featuring advertising of organizations who have immediate openings in their company.

Electronics Week's weekly frequency will keep you up-to-date on the job market on a regular basis

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McGraw Hill

UPCOMING EDITORIAL SCHEDULED FOR ELECTRONICS WEEK MAY 1985 ISSUES

Issue Date	Editorial Emphasis
May 6	The Realities of Voice and Data Integration
May 13	The Multi-Billion Dollar Field Service Business
May 20	Gallium Arsenide Integrated Circuits
May 27	Computer Graphics Trends

JOBS MAY JOBS MAY JOBS MAY JOBS MAY JOBS

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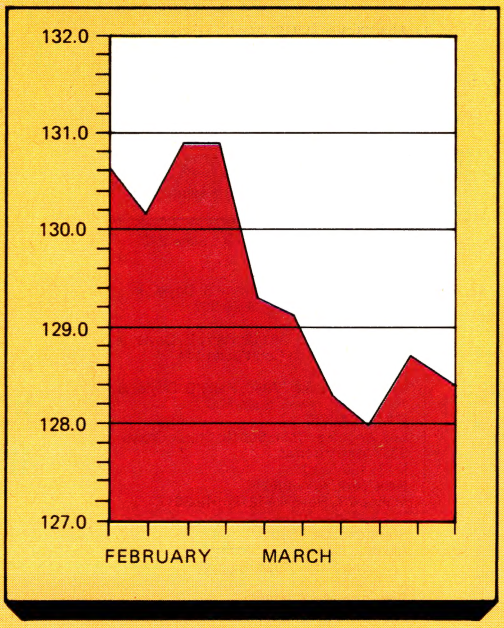
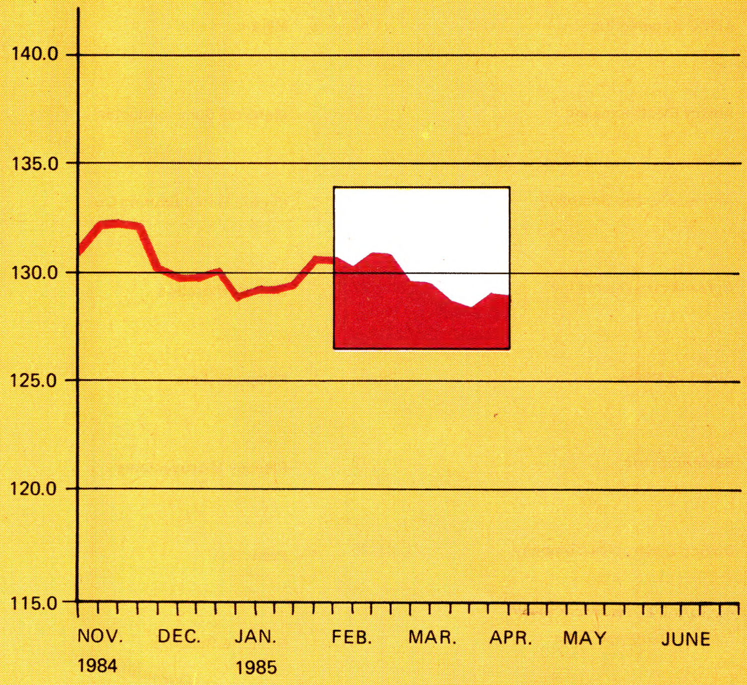


THIS WEEK = 128.4
LAST WEEK = 128.7
YEAR AGO = 124.9
1982 = 100.0



The *ElectronicsWeek* Index, a seasonally adjusted measure of the U.S. electronics industry's health, is a weighted average of various indicators. Different indicators will appear from week to week.

U.S. ELECTRONICS INDUSTRY EMPLOYMENT

Production workers (thousands)	February 1985	January 1985	February 1984
Office and computing machines	192.9	194.2	199.2
Communications equipment	296.3	297.1	271.1
Radio and TV receiving equipment	57.7	58.2	61.8
Components	410.3	417.6	394.6

U.S. GENERAL ECONOMIC INDICATORS

	March 1985	February 1985	March 1984
Average prime rate (%)	10.50	10.50	11.00
Retail sales ($ billions)	110.541	112.736	105.726
Unemployment rate (%)	7.2	7.2	7.7

With employment levels in electronics production still slipping, the *ElectronicsWeek* Index dropped by 0.2% in the latest week. Total employment of electronics workers declined 1.1% in February, according to the latest information from the U.S. Bureau of Labor Statistics. The hard-pressed components industry again racked up particularly severe labor reductions, as chip manufacturers sought to reduce costs in the face of one of the most severe business slumps in the industry's history. The office-equipment industry has suffered the most serious year-over-year payroll decline. Hard times have reduced its worker ranks by more than 3%. Employment in the communications-equipment sector is up from its level of a year ago but off fractionally from the previous month, according to the data.

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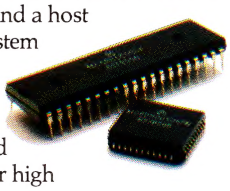
Get MC68HCO5C4 performance below $6 in volume. Now.



The MC68HC05C4 is your way to get Motorola's easy-to-use 8-bit MCU architecture, with a powerful, enhanced M6805 core, 4K of ROM and a host of other on-chip system functions, at prices that start below $10 for minimum quantities and plunge under $6 for high volumes.

Motorola's MC68HC05C4 is in volume production and available now, bringing the high performance and greater chip density of HCMOS to the popular M6805 single-chip MCU family for the first time.

This evolutionary combination of positives makes it your easy MCU choice for upgrading existing M6805 systems as well as for a broad range of new general-purpose and controller designs.

On-chip functions galore.

On-chip functions include 176 bytes of RAM retainable on standby, an oscillator with RC or crystal mask options, 24 bidirectional I/O lines, an 8x8 unsigned multiply, a 16-bit enhanced 6801 timer, five interrupt vectors, an enhanced UART (SCI) and a synchronous serial system (SPI).

Other compatible family options will be offered for emerging design requirements.

High performance from HCMOS.

HMOS technology enables the high level of integration and advanced performance on an extremely small chip demonstrated by the MC68HC05C4. Standard operation at 2.1 MHz bus frequency is twice as fast as previous M6805 Family MCUs. And, yes, low-power operation is inherent. The fully-static design allows operation down to dc. Stop and wait modes further enhance power savings for ultra low-power applications.

And, the clinchers.

All this should make the MC68HC05C4 your preferred MCU for that vast range of applications between the low-cost territory of the M6804 Family and the ultra high performance province of the MC68HC11. Or be convinced by software capabilities that include true bit manipulation, memory-mapped I/O, addressing modes with indexed addressing, and upward compatibility with the M146805 Family.

Efficient use of program space, versatile interrupt handling and a highly efficient instruction set are no less important reasons to choose the MC68HC05C4.

Finally, development support is available using various hosts with Motorola's HDS-200 emulator system. The HDS-200 system features a full HCMOS target interface with voltage tracking.

One-on-one design-in help.

Now you can get an engineer-to-engineer update on all our latest semiconductor products and technologies, and how they can enhance your unique designs.

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Call toll-free any weekday, 8:00 a.m.-4:30 p.m., M.S.T. If the call can't cover your needs, we'll have a local field applications engineer drop by. And get you to market. Faster.

For technical literature on the MC68HC05C4, fill out the coupon and send it to Motorola Semiconductor Products, Inc., P.O. Box 20912, Phoenix, AZ 85036.

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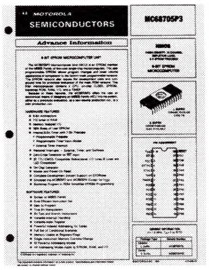

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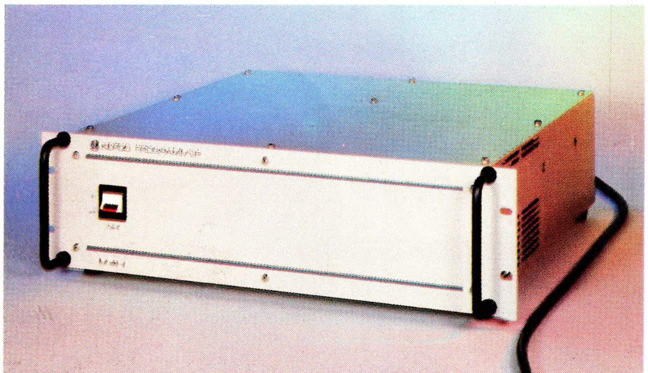

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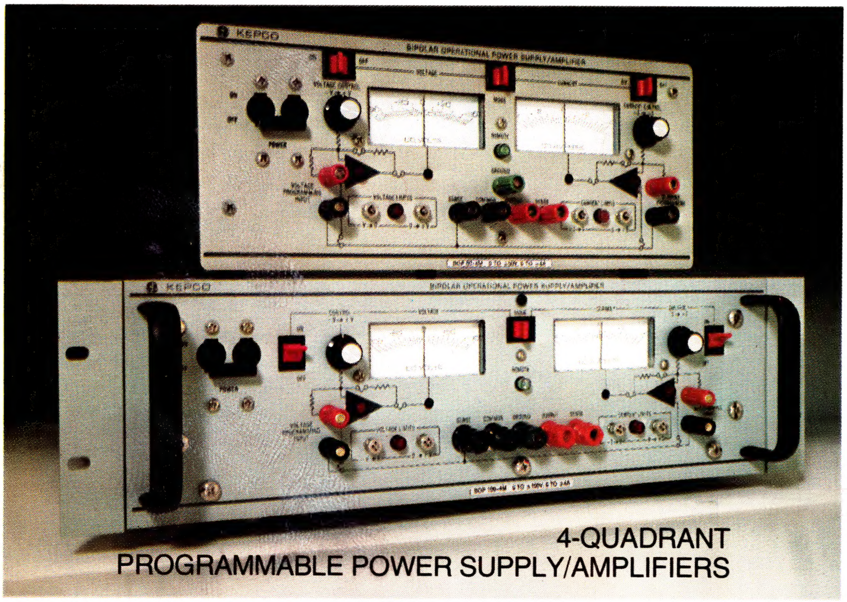

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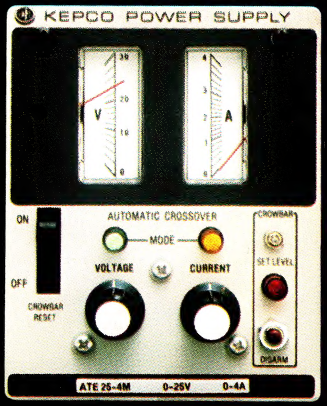

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